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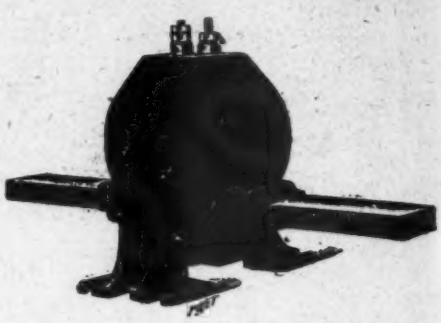

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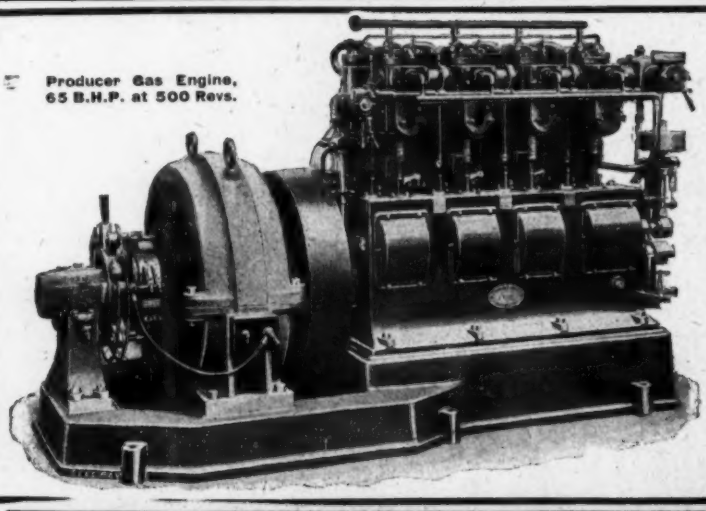

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ELECTRICAL REVIEW.

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GERMAN COMPETITION IN THE ELECTRICAL TRADES.

EVERY day brings evidence of the fact that Germany is making another bid for the manufacturing trade of this country.

The Board of Trade returns recently published show that: (1) The imports of manufactured and partly manufactured goods from Germany for nine months in 1913 amounted to 41 million pounds. (2) The imports from the same source, for the same period of the present year (1920) totalled 17 million pounds.

The full significance of these figures can be realised by a reference to past history. Memories are proverbially short, and it may not be amiss to recall what the position was before the war and after the war started.

Before the war Germany by her policy of "peaceful penetration" had managed to secure something like 80 per cent. or 90 per cent. of the British trade in electrical accessories. This had been accomplished by dumping immense quantities of these goods at prices which made the production of such articles unprofitable to British manufacturers. This naturally had the anticipated and hoped-for result of discouraging or freezing-out would-be makers, leaving a few old-established firms to share amongst them the small balance of business obtainable from those (unfortunately now so few) who had a preference for good-class British-made goods. Then came the war!

When the war started the Government of this country soon found that British makers of electrical accessories were quite unable to furnish sufficient of these articles to meet urgent war requirements. British makers were immediately urged to "get a move on," and other firms decided to take up the manufacture, helped no doubt to that decision by the Government promise of protection after the war. The whole country seemed to be fully alive to the fact that our pre-war policy of allowing Germany to get the trade into her hands was wrong. Never more! said the Government, must this thing happen. After the war we will bring in a Bill to prevent it. Never more! echoed the Press. One comic paper (very comic it appears now) published a cartoon of "the bravest man in this world," depicting a German traveller about to land on these shores.

And now, in this year of grace and peace, how do we stand? The Bill that was to prevent the British manufacturer from losing his trade to Germany has been postponed to next session, but the Government is still (two years after the war) "giving the matter anxious consideration."

The Press now appears to be undecided; one Birmingham paper a few days ago expressed the view that "we must approach this question (of trading with Germany) sympathetically, in view of the increase in unemployment," the implication being that by importing German goods we should reduce unemployment; and so, no doubt, we should—in Germany.

In a recent issue of the ELECTRICAL REVIEW we reported that "all the electrical works in Germany are full of work, and have heavy and pressing orders on hand, including large orders from England, &c."

We have recently received from correspondents particulars of electricity meters offered by a Swedish firm, of German manufacture, and motors and generators offered by a company with an English name but foreign directorate, domiciled in London, these machines also being of German make, the prices in both cases being extremely low; doubtless there are many other channels by which German products reach this country.

Meanwhile the British manufacturer views with dismay his empty order book, dismisses the workpeople for whom he can no longer find employment, and wonders how long he can continue to stock the goods for which he has no sale.

The German traveller, who was to have been met by the Britisher with a dog-whip in one hand and a replica of the *Lusitania* medal in the other, is with us once again, and plentiful supplies of German-manufactured goods are on sale in every large town in England.

Whilst British workpeople are walking the streets looking for work that has gone to Germany, Englishmen (?), many of whom just escaped internment during the war, are planning trips to the Fatherland with the intention of handing over the balance of British trade to their friends. The firms these good people represent (or misrepresent) are not feeling any slump—of course not. Whilst the war was on they supported the British manufacturer (and duly advertised the fact), but they now have no further use for him.

From the Board of Trade figures referred to at the commencement of this article, it will be seen that the Germans have already got back over 40 per cent. of their pre-war total of British trade, and it seems fairly certain that by the end of another year, the remaining 60 per cent. will fall into their hands. Thus the Englishman's "nevermore" can be translated into a term of about three years. As a German said: "We Germans can never be gentlemen, and Englishmen will always be fools."

The Whitley Scheme.

The present time is probably a crucial one in the history of the electricity supply business. The industry is faced at the present moment with the task of giving the Whitley scheme its final form. The industrial future of the industry will, in a great measure, be governed by what shape is now given to the scheme. There are two main questions outstanding: one is the formation of District Joint Boards for the staff (in conjunction with the National Joint Board); and the other, the relationship which, in future, is to be maintained between the four employers' associations and the Joint Boards and Industrial Councils.

At present the position is that the Whitley report has been followed with regard to the construction of the National Board and the National Council, but has not been followed with regard to the construction of the District Councils. There is consequently an anomaly which has given rise to proposals to amend the present arrangement. The Whitley report suggests that the representation of the employers on both the National Council and the District Councils should be by members appointed directly by the employers' associations. Now, the National Council and the National Board have been composed in this way. But the employers' representatives on the District Councils have been appointed direct, by the local undertakings, without reference to the employers' associations. The question has now been raised as to direct representation of the District Councils on the National Council. If this were done, that is, if the National Council were elected by the District Councils, all direct control by the employers' associations would be abandoned. If the representation of the District Councils on the National Council is partial, then to that extent the direct influence of the associations will be diminished. Whatever is done in this way in connection with the District Councils will necessarily follow in the construction of the District Boards, and *vice versa*. The effect of the National Council being derived directly from the District Councils would be that the Councils as a whole would become independent of any other organised body. That is, the final authority, the National Council, would be reached by the individual undertaking only through the District Council. In other words, the power of the individual undertakings would be greatly reduced, and the power of the Councils as a whole correspondingly augmented.

The recent dispute over the recommendations issued by the National Joint Board with regard to technical staffs raised amongst other things, this issue. An individual undertaking demurred (we put it mildly) to acceptance, saying that the award was issued by a body in the constituting of which it had had no direct voice, and that it had had no opportunity of presenting its views as to adjustment to local conditions—in a word, that there was no District Board.

The completion of the organisation of the Whitley scheme is thus obviously a matter of immense moment to the industry, and one demanding the most serious deliberation. An ill-organised set of Councils and Boards is clearly a danger. On the other hand, once soundly organised on a permanent basis, they will form a powerful factor for good if it be true that cordial co-operation between employed and employers is possible. But everything depends on their equipment.

At the present moment, the weaknesses of their anomalous organisation are being felt in the lack of co-ordination in policy between the various District Councils of the country. The fact that the employers' associations have no direct representation on the District Councils means that at present there are no means by which such co-ordination is possible. Any co-ordination by way of the National Council is debarred by the fact already mentioned, that the District Councils have no direct representation on the National Council.

The foregoing, then, are some of the elements in the problem with which the industry is faced The alternative courses open to the employers' side are:—One, to let things settle themselves haphazard; the other, which, if it is to be done at all, must be done immediately, is to decide on a definite and comprehensive policy.

Employment Abroad.

The young engineer who is tempted to accept service abroad, whether under the Secretary of State for India or a Colonial Government, should take a legal opinion before he signs his contract. The importance of doing this was emphasised in the case of *Denning v. the Secretary of State for India*, which was heard before Mr. Justice Bailhache on November 29th. It was there decided that a Crown servant, against whom no misconduct is alleged is liable to dismissal at the pleasure of the Crown without notice, even if the form of agreement under which he has been engaged implies that, except in the case of misconduct, the engagement can be terminated only by notice. The facts of the case (as reported in *The Times*) were such as to induce the learned judge to say that he sympathised with the plaintiff, and to suggest that those who advised the Secretary of State should adopt a form of contract which would be less misleading. It appears that the plaintiff signed a contract in writing on September 30th, 1909, under which he was employed by the Secretary of State as superintendent of industries and inspector of technical and industrial institutions in Bengal for five years from his reporting his arrival in Calcutta. He commenced work in 1910, but on January 8th, 1913, his employment was terminated on purely medical grounds. There was no suggestion of misconduct. We anticipate that it will be a surprise to some lawyers and to most laymen to be informed that when a contract to serve a definite term with the Crown is put into writing, and that writing specifically states that there may be dismissal for misconduct, the rule that a Crown servant may be dismissed at His Majesty's pleasure is still to be applied! That such a rule is sound in its general application may be admitted, but we venture to agree with the learned judge that "no one who was not familiar with the law on reading the contract could suppose that the person engaged was liable to dismissal without notice at the pleasure of the Crown." That he was of opinion that the plaintiff was harshly treated appears from the fact that Mr. Justice Bailhache dismissed the action, but without costs.

NEW PICCADILLY RAILWAY ROLLING STOCK.

On Wednesday, December 8th, a party consisting of representatives of the Press, and others interested, took part in an inspection and trial run of the first of a series of new trains being placed in use on the Piccadilly (London Electric) Railway.

Forty of these cars were ordered from Messrs. Cammell, Laird & Co., Ltd., in 1919, and delivery was promised by the middle of the present year. Owing to labour troubles and the difficulty of obtaining materials, however, delivery has only just commenced, but it is hoped to complete four per fortnight, and so the whole of the cars should be in service early next year. The cost of the order amounts to about £120,000.

The length of the new car (fig. 1) is 50 ft. overall, and a number of new features have been embodied in its construction. The seats, which are arranged parallel to the length of the car, accommodate 44 passengers, and are made more comfortable by giving them a backward inclination. They are upholstered in imitation leather. The corridor is much more ample in this type owing to an extra 10 in. in the width of the car. Straps are not provided for standing passengers, but the usual rails are brought a little lower for use as hand-rails, while vertical rails fitted between the seats and the roof are provided in addition.

The lighting is extremely good, as the view of the car interior (fig. 2) will show. It will be seen that the lights are arranged in pairs at frequent intervals. Above the waist of the car the interior is painted cream colour, giving a mellow reflection. The alteration of the roof to an elliptical shape from the usual clerestory type gives a more efficient reflecting surface; roof advertisements are to be restricted. Emergency lighting is supplied from a storage battery, and comes into operation automatically immediately a failure occurs in the ordinary lighting. The door arrangements are a new departure in electric car construction. The car has single sliding doors at one end and double doors in the centre, and it will be seen from the illustration (fig. 3) that ample means of ingress and egress are provided. The whole of the doors are controlled by the guard of the train. They are opened and closed by compressed-air apparatus, electrically controlled. Should a passenger be caught in a door while it is being closed, the door will immediately return to the "open" position. The guard, by looking along the train, can see if all doors are closed, by means of indicators (seen in fig. 3) which close in when the doors are shut. The motorman cannot receive his starting signal until all the doors are closed.

It is intended to run these new cars in trains of six, and the old cars thus released will be added to the existing five-car trains in order to make a continuous six-car service. This will mean an all-round strengthening of the services and a relief of the present congestion. It is stated that the new cars represent an addition of over 26 per cent. to the existing car strength of the Piccadilly line. The new trains will make about 12 journeys during the "rush hours" of the day, and will, therefore, provide additional accommodation for 21,120 passengers daily.

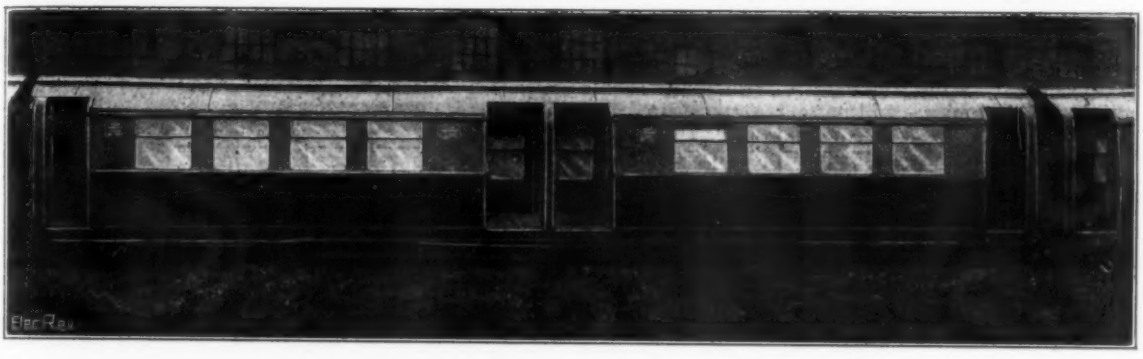


Fig. 1.—General View of Exterior of New Car.

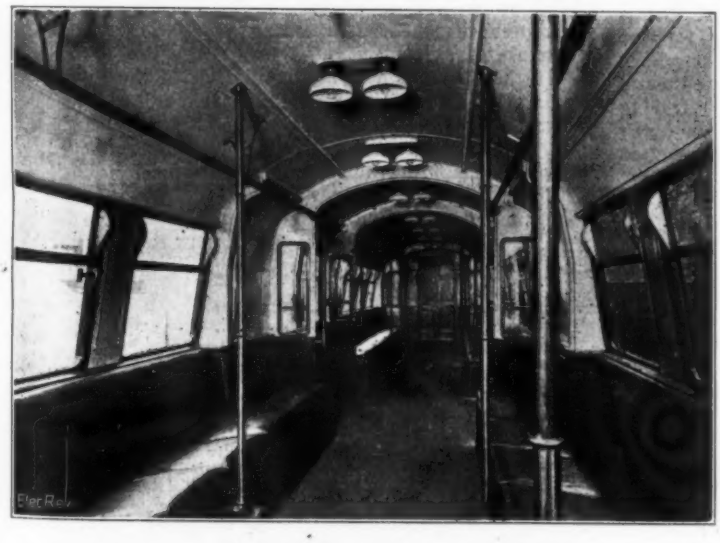


Fig. 2.—View of Interior of Car.

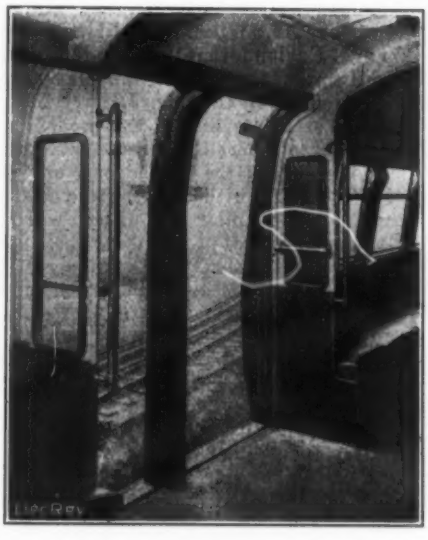


Fig. 3.—Sliding Double-doors.

ELECTRICITY IN MINES.

From the recently-issued reports of H.M. Inspectors of Mines, we learn that the total quantity of coal obtained in the year 1919 was 229,779,517 tons, which includes an amount of 36,389 tons obtained from open quarries. The total obtained in 1918 was 227,748,654 tons, so that there is an increase of over two million tons, which whilst satisfactory, is very far below the output for the year 1913, which was 287,411,869 tons. The total mineral output for the year 1919 was 239,600,939 tons, which includes coal, fireclay, ironstone, oil shale, and other minerals, but in each case the output is very considerably below that for the year 1913, when the total mineral output reached 301,611,353 tons, being the highest output on record in this country. The miners, however, are working one hour per day less, which—in spite of all the assurances from the miners and others who thought they knew all about the miner and coal getting, that output would not be reduced—will account for much of the reduction, as in 1913 there were employed under the Coal Mines Act 1,127,890 persons, and in 1919, 1,191,313, or 63,423 more employés for 62,010,414 tons less output. This is very far from being satisfactory, and it is to be hoped that both coal owners and miners will not only settle their differences at the conferences now taking place, but will investigate thoroughly the reasons for the smallness of the output, and devise means and methods for increasing it. A plentiful supply of coal is vital to the life of this country.

With regard to fatal accidents, it is satisfactory to record that the year 1919, though not the lowest, was the lowest but one in the death rate, this being 4.67 per 1,000,000 tons raised, 0.3 more than the lowest record, which was in the year 1914. Still it is very sad to know that coal-getting cost 1,118 valuable lives in 1919, and it is the sincere wish of everyone connected with the industry that this dreadful yearly toll of human lives may be reduced. On this point it is stated by Mr. Wilson, Divisional Inspector for the North of England, that "taking the fatalities as a whole, 45 per cent. of them were avoidable by ordinary care and precaution." Again, Mr. J. Dyer Lewis, in referring to fatal accidents due to the use of explosives, says: "I regret to report that all the fatal accidents resulted from breaches of the regulations, or want of ordinary care." Again, with reference to shaft accidents, we read: "It is singular that pitmen will not use life-belts or other appliances provided for their use when examining or repairing shafts."

With regard to coal-cutting machinery, it is satisfactory to note that its use is still increasing. In the Scotland Division the inspector reports: "There was an increase of 108 in the number of coal-cutting machines at work, and of 177,364 tons in the quantity of mineral obtained by them, compared with the figures for 1918. The total quantity of mineral cut by mechanical coal-cutters was 10,379,495 tons, of which 9,507,912 tons were got by machines driven by electricity, and 871,583 tons by machines driven by compressed air. A comparison with the figures for 1913 shows that 313 more machines were employed and 1,044,043 tons more obtained by this means in 1919 than in 1913, and 40 fewer driven by compressed air. The number of mechanical conveyors in operation at the working face during the year was 105, compared with 125 in 1913."

In the Northern Division the inspector reports: "The use of coal-cutting machines has made some headway during the last five years, and probably would have made more progress if the machines themselves, and more particularly the air compressors for generating the power, had been available.

"During the year 1914, the last year for which the figures were given, 3,574,312 tons of coal, 6.8 per cent. of the total output, were obtained by the use of 702 coal-cutting machines. In 1919 the quantity so wrought had increased to 4,380,593 tons, or 10 per cent. of the total output, and the number of machines had gone up to 1,025; the greater increase by far is in compressed air machines. The number has advanced from 546 in 1914 to 854 in 1919, a jump of 56 per cent.; whereas electrically-driven machines have advanced only from 156 to 171, or 9.6 per cent. The application of coal conveyors has not made the same strides; the number in use in 1919 was only 87, as compared with 68 in the year 1914.

"There is not much doubt but that greater developments in these labour-saving appliances will take place in the future, as the diminishing quantity of hand-got coal will compel the resort to every known device for supplementing the output."

In the York and North Midland Division the inspector reports: "The quantity of coal obtained by coal-cutting machines was 6,979,454 tons. The coal-cutting machines employed numbered 880, made up of 269 disk, 110 bar, 334 chain, 162 percussive, 5 rotary heading. The number of mechanical conveyors in use was 162."

In the Lancashire, North Wales, and Ireland Division the inspector reports: "The quantity of coal obtained by coal-cutting machines was 2,780,092 tons, of which 2,456,794 tons were got with machines worked by compressed air, and 323,298 tons by electrical coal cutters. There were 737 machines worked by compressed air and 58 worked by electricity. There were 45 coal conveyors at work in the division."

In the South Wales Division the inspector reports: "The quantity of coal obtained by coal-cutting machines was 897,047 tons. The number of disk machines in use was four, the number of bar machines in use was 38, the number of chain machines in use was 104, and the number of percussive machines in use was 36. The number of mechanical conveyors at the working face was 285. The above machines were used in 56 mines. The figures show an increase of 26 coal-cutters, and an increase of 73,243 tons of mineral cut over that of the preceding year. There was an increase of 71 conveyors."

In the Midland and Southern Division the inspector reports: "The quantities of mineral obtained by coal-cutting machines were: Coal, 2,243,389 tons; fireclay, 800 tons; and ironstone, 401,475 tons. The coal-cutting machines employed numbered 411, comprising 39 disk, 26 bar, 206 chain, 136 percussive, four rotary heading. The number of mechanical conveyors in use was 28."

The following tables give particulars relating to the use of coal-cutting machinery:—

	1918	1919
Number of collieries where machines are at work	695	729
Number of machines	4,041	4,482
Work by electricity	1,797	1,950
Work by compressed air	2,244	2,532
Mineral obtained	27,873,646	28,081,017
Number of conveyors at coal face ...	613	712

Coal-cutting machines driven by electricity: disk, 876; bar, 489; chain, 573; percussive, 7; rotary heading, 5; total, 1,950.

Coal-cutting machines driven by compressed air: Disk, 388; bar, 128; chain, 400; percussive, 1,598; rotary heading, 18; total, 2,532.

Gross total in 1918, 4,041; gross total in 1919, 4,482.

The extent of application of electricity to mining machinery is shown in the following table for the coal mines, which number 1,492:—

Surface.—Winding, 51,968 H.P.; ventilation, 77,176; haulage, 44,714; coal washing and screening, 75,011; miscellaneous, 193,764; total, 440,633 H.P.

Underground.—Haulage, 241,123 H.P.; pumping, 270,486; portable machinery, 55,791; miscellaneous, 19,921; total, 587,321 H.P.

Gross total, 1,027,954 H.P.

The extent of application of electricity to mining machinery is shown in the following table for the metalliferous mines, numbering 77:—

Surface.—Winding, 1,120.5 H.P.; ventilation, 9; haulage, 904.5; miscellaneous, 7,857.5; total, 10,633.5 H.P. (including 742 H.P. not detailed).

Underground.—Haulage, 1,383.5 H.P.; pumping, 7,392.5; portable machinery, 18.5; miscellaneous, 1,039; total, 10,282.5 H.P. (including 449 H.P. not detailed).

Gross total, 20,916 H.P.

The next table shows the increase in the growth of the use of electricity for all purposes:—

	1918. H.P.	Per cent. increase on previous year.	1919. H.P.	Per cent. increase on previous year.
Surface ...	416,775	6·39	441,606	5·96
Underground	548,592	5·12	587,321	7·06
Total ...	965,367	5·66	1,028,927	6·58

The number of electrically-driven coal-cutting machines in use at the end of 1919 was 1,950, an increase of 153 over the number in use at the end of 1918. The increase was 8.5 per cent., as against an increase for the previous year of 3.3 per cent. only.

During the year 1919 there were in all nine fatal accidents at mines definitely due to electricity which were investigated by H.M. Inspectors of Mines. These nine accidents caused nine deaths. In addition electricity was suspected to be a contributory cause in an accident whereby an explosion of firedamp and air resulted in the death of six persons and serious injury to six others.

Of the nine electric shock accidents above referred to, three took place on the surface and six below ground. The figure for electric shock accidents below ground is the same as in the previous year.

Number of persons killed by electric shock below ground in coal mines: 1907, 10; 1908, 12; 1909, 13; 1910, 15; 1911, 9; 1912, 7; 1913, 13; 1914, 4; 1915, 8; 1916, 4; 1917, 2; 1918, 6; 1919, 6.

The following are short details of the circumstances relating to the accidents:—

1. Deceased received a fatal shock from the framework of a coal cutter when the machine was running. The accident was due to joining together two lengths of trailing cable, by which the frame of the coal-cutting machine was connected to the inner (live) core of the concentric cable instead of to the outer (dead) core; also to a fault in using a trailing cable with a break in the earth connection.

2. Deceased, a by-worker, pulled the pomel of a 4-core trailing cable out of a conveyor motor starter with the current on. Through a defect the pomel became electrically charged, and the neutral point of the 500-volt, 3-phase system being earthed, he received a fatal shock.

3. A haulage motor having refused to start, the fireman opened the door of the switchbox to see if anything was wrong, and deceased, who was standing by him, suddenly put his hand into the box, and touching the live terminals, was killed.

4. Deceased was killed by an electric shock from the haulage rope of a coal-cutting machine. The supply was alternating current at 440 volts; the machine casing and the rope became alive owing to the trailing cable becoming jammed under the machine, and being damaged to such an extent that there was direct contact between the machine and one of the power leads in the cable.

5. While engaged in cutting the coal a "short" developed on the machine, and owing to the pin connecting the earthing system to the machine becoming loose and defective, a man received so severe a shock that it immediately killed him.

6. Deceased removed an electric lamp from the holder in the blacksmiths' shop at the surface, and whilst tampering with the live terminals of the lamp holder, he received a fatal electric shock.

7. Deceased was found beside a switch, which he had just opened to stop a motor. The switchboard was bolted to a light iron frame and subject to great vibration; the switchbox had been partly pulled away from its fastenings, and the connection to the earth conductor was broken.

8. Deceased was killed by leakage of current from a coal-cutting machine. The cause or source of the leakage could not be discovered; the protective earth circuit was, however, defective. The bat connector at the gate end box had not been properly fixed, and the holding bolt was not screwed home. The connection to earth, therefore, at this point depended entirely upon contact between the metal surface of the bat and the box or socket into which it was fitted. It was found afterwards that through corrosion of the metal of the bat and accumulated dirt upon it, the conductance of its surface was nearly nil.

9. Some electric lighting cables with merely a braided covering, and carrying a current at 220 volts, were held up by a temporary pole where they crossed a conveyor. The chain of the conveyor got out of its runners, and whilst it was being replaced, deceased, although warned, touched one of the cables and received a fatal shock.

Although there was no increase from the previous year, and the record is satisfactory to that extent, consideration of the details of each accident given above shows that without exception all might have been avoided by attention to simple and well-established safeguards. The fact that five of the six fatalities occurred to persons engaged in operating coal-cutting machinery is significant of the necessity for better supervision and maintenance of this form of plant. All were due to defects in the earthing circuit. The following generalised remarks by Mr. Horsley, the Electrical Inspector of Mines, on the subject of trailing cables and connectors should be carefully noted and considered by the management of mines at which electricity is used with portable motors for coal-cutting or other purposes.

"One point emerges with cumulative insistence, and that is the urgent need for radical improvement in the design of the connectors, termed bats or pomels, used with trailing cables in order to secure and maintain adequate earthing of the portable apparatus.

"It does not appear to have been sufficiently realised that conductivity and reliability of the earth continuity device is of even greater importance than the corresponding features of the live circuit. Any discontinuity in the live circuit is self-advertising, but a break or increase of resistance in the earthing circuit can only be detected by inspection and test. Excellence of design, however, will be of little avail, unless methodical maintenance is carried out.

"There is scope also for development in the design of trailing cable. Reasonable mechanical protection is afforded by cab-tire sheathing, now in almost universal use, but a risk remains. In case of abrasion or incision a live conductor may be exposed and brought into contact with persons, or with conducting material from which a dangerous shock may be received. It is also possible that the earthing conductor of a three- or four-core cable may be severed while the live conductors remain intact. A design of trailing cable in which the live cores and the principal earthing core are enveloped by a supplemental flexible earthed conductor would approximate more nearly to the condition of safety from shock which is attained by the use of an armoured cable for the main circuits."

With regard to safety lamps, the numbers of oil and electric lamps in use were: Oil, 636,158 (previous year 590,185); electric, 197,722 (previous year 156,521).

The number of shots fired by electricity was 26,953,674.

The total number of horses used underground in mines was 66,574. We are firmly of the opinion that electrical machinery could take the place of most of these animals.

A Polish Cable Factory.—The A.G. Kable Polski is reported to have been formed at Bromberg with the object of rendering Poland independent of cables from Germany, the share capital being 20,000,000 Polish marks. The technical manager, who is a Pole, was formerly associated with the Deutsche Kabelwerke of Berlin-Lichtenberg.

WESTERN ELECTRIC TELEGRAPH AND TELEPHONE SYSTEMS.

As briefly mentioned in our last issue, we recently had the privilege of witnessing a demonstration of the latest approved models of the Western Electric Co.'s multiplex and "Start-Stop" printing telegraph systems, including a repeater of the rotary type with provision for extending arms both at the repeater and at a terminal station. Fig. 1 shows in schematic form the equipment included in this demonstration.

Between station A and station B was an artificial line of 2,000 ohms. Between station B and station C a line was provided by using one wire of a telephone pair, on the "Composite" or modified Van Rysselberg system. Telephones were connected at both ends of this line, so that the noise produced by telegraph signals might be listened for.

The extensions to the "start-stop" sets were made by two wires. If duplex balancing sets were provided at stations D and E, and additional balancing sets at stations B and C, it would be possible to operate to stations D and E over one conductor only in each case. Where the distance between

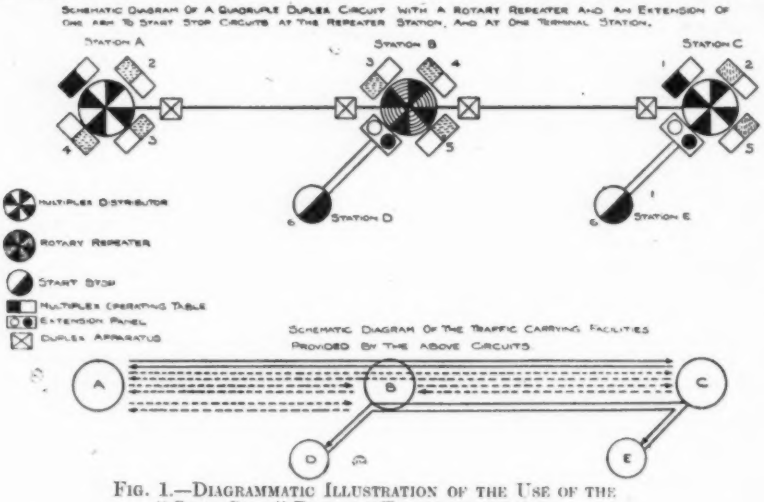


FIG. 1.—DIAGRAMMATIC ILLUSTRATION OF THE USE OF THE "START-STOP" PRINTING TELEGRAPH APPARATUS.

stations B and D and between stations C and E exceeded two or three miles, it would be preferable to introduce duplex balancing sets and separate line batteries. With the arrangements shown in the demonstration no line batteries are required at stations D and E.

The lower portion of fig. 1 shows the traffic-carrying facilities provided. Many other combinations are possible; the demonstration only showed the fundamental idea of the scheme.

At the repeater station B, the incoming signals from A actuate two polar relays alternately, storing up each impulse for sufficient time to permit of its repetition in the direction B to C by means of brush transmission. This ensures that, although the incoming signals at station B are distorted, the outgoing signals are perfect. The same applies to the signals going in the opposite direction. The repeater station is the "pace-setting" station. Line lag is taken up at the two terminal stations, so that the repeater station is free from all adjustments of orientation.

The two "start-stop" distributors are adjusted to run at a higher speed than the multiplex distributors, and have a wide margin in this respect; for instance, if the multiplex distributors are rotating at 240 revolutions per minute, the start-stop distributors may be adjusted to run at any speed between 260 and 360 revolutions per minute. If the start-stop distributors are adjusted for 320 revolutions, the multiplex distributors may be adjusted to any speed between 220 and 300 revolutions without changing the speeds of the start-stop sets. Further, with start-stop sets connected through a multiplex as shown in the demonstration, one set may be adjusted for 260 revolutions and the other for 300 revolutions.

Switching arrangements are provided for operating the two start-stop sets as straight duplex over the "composite" circuit, the duplex balancing sets at station B and C being used for balancing.

Under these conditions one start-stop distributor may be running about 5 per cent. faster than the other and give perfect operation. By providing two start-stop tables for duplex working with two operators it is possible to receive on table No. 1 and transmit from table No. 2, or switch over and receive on table No. 2 and transmit on table No. 1. At small stations, where reserve apparatus must be installed ready for use, this provides means for ensuring uninterrupted service.

Start-stop sets can be adjusted to operate at any speed between about 25 and 60 words per minute. Large speed changes are effected by turning a switch which re-arranges the motor circuit; small speed changes are effected by adjustment of the motor governor. This is done by means of a lever at the side of the distributor set. Either tape or direct keyboard transmission may be used. To change from the one to the other it is necessary only to turn a cam switch conveniently mounted on the table.

The apparatus on the distributor table is mounted in a very compact and yet convenient manner; the relays and the fork are mounted on swinging shelves, which swing under the main top of the table clear of all risk of interference. The fork base has rubber feet, so that the vibrations are damped out, and are not carried to the shelf on which the relays are mounted.

All the switches are of the telephone switchboard type; these have been used in the United States for some years and have been found to give satisfaction.

In the distribution box beneath the fork shelf the wiring from the four operating tables is brought to four porcelain panels, suitably lettered and numbered. Fixed resistances, condensers, fuses, &c., are all suitably mounted and easily got at.

The distributor is of novel construction, providing for the quick replacement of worn segments.

So far as the multiplex apparatus units are concerned, the multiplex may be operated up to a speed of about 52 words per minute per channel. This is the equivalent of 208 words per minute in each direction, or 416 words per minute for the circuit. Line conditions, however, may prevent such speed of working; therefore the vibrating fork which drives the impulse motor of the distributor is provided with weights, so that its rate of vibration may be varied to give any working speed between 25 and 52 words per minute per channel.

In cases where the traffic is practically all in one direction, such as private newspaper wires, it is not necessary to equip both ends of the circuit alike. For instance, in one direction there may be four channels each operating at 52 words per minute (total 208 words), and in the other direction only one channel. This makes for a more economical installation.

The start-stop may be operated either simplex or duplex. For over a year a start-stop duplex circuit has been in operation between New York and Chicago, nearly 1,000 miles in length, with one female operator at each end; this circuit is provided by superimposing on a telephone line. The average daily load for nine hours is over 22,000 words, or about 1,000 messages. The transmitters are set at 35 words per minute in each direction. This slow speed gives the operator so much spare time in the preparation of perforated tape, that she is able to check the received messages as well.

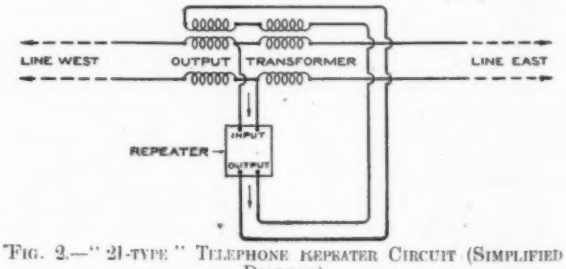


FIG. 2.—"21-TYPE" TELEPHONE REPEATER CIRCUIT (SIMPLIFIED DIAGRAM).

It is possible to provide intercommunication between a number of offices by means of the start-stop when operated simplex; it is possible also to associate with the start-stop sets selectors by means of which any one of a number of stations may be called, the printers at the other stations remaining idle.

To meet the need for an absolutely secret telegraph system, the company has designed a system which may be used with either wire or wireless transmission. Two transmitters of the type used in the multiplex and start-stop printer systems are interconnected through a local rotating distributor to a re-perforating machine. In one transmitter is placed a continuous tape of any suitable length, perforated with a dummy message or with a series of random signals; this is termed the "scrambling tape." In the other transmitter is placed a tape perforated with the message which is to be dispatched. When the two transmitters are started off together, the signals from both tapes act upon the electromagnets of the reperforator, producing a perforated tape which is unintelligible to anyone. This tape is then used for transmission over a telegraph circuit using the same fundamental code (5 unit).

At the receiving end of the line the message is received as a perforated tape, identical with that fed into the transmitter at the sending end.

This received tape is then fed into one transmitter of a local deciphering set comprising two transmitters, a distributor and a printer. At the same time a tape identical with the "scrambling tape" used at the sending end is fed into the second transmitter, the signals from the two tapes acting together upon the printer. The printer prints the real message exactly as prepared at the sending station.

The enciphering and deciphering can be done at the rate of 50 words per minute, and the whole process need not cause one minute's delay more than would be incurred in transmitting a message in the ordinary way.

Amongst the many advantages claimed for the latest type of the Western Electric multiplex printing telegraph system, as compared with the Baudot system, are the following:—

Owing to the elimination of correcting impulses, a gain in carrying capacity (words per minute) is obtained when the speed of transmission in cycles per second is the same,

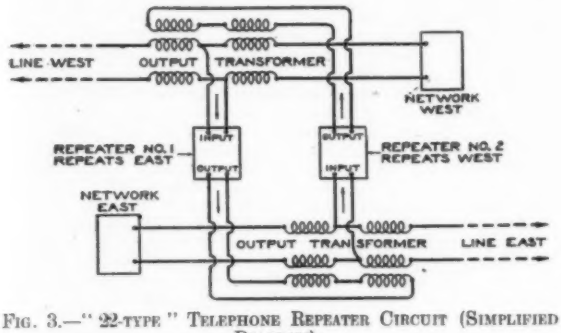


Fig. 3.—"22-type" Telephone Repeater Circuit (Simplified Diagram).

amounting with double duplex to 20 per cent. The speed of operation over the line can be changed in a few minutes. No synchronism is required between the rotating brushes of the distributor and the printers, and no adjustment of the printers is necessary when the speed of working is changed. The transmitting operators do not work to a cadence. No line time is lost between messages. Detecting errors at the sending end can be obliterated. No special training of operators is required; a typist can handle traffic the first day.

The new type also possesses many advantages over the old apparatus of the company, including greater facilities for speed checking and phase finding, the elimination of line lag as a factor to be considered, self-starting of the impulse motor, and the use of standard duplex sets.

The multiplex set can be switched over to an already balanced duplex set, in the event of the usual line becoming faulty, without losing time in obtaining a new duplex balance.

The improved printer is of the mechanical type, with standard typewriter typebasket mechanism; it has a stationary paper carriage, the typebasket sliding along the paper. This results in less eye-strain to the operator, and also permits of the easy feeding of individual blank forms by hand, or the use of a continuous roll. Carbon copies may be made and stencils can be cut. The maximum speed is about 100 words per minute, but all tensions have been let down to limit the maximum speed to about 70 words per minute; this makes for lower maintenance costs.

The telephone demonstration was equally interesting. The exhibit comprised a two-wire circuit and a four-wire circuit, each having two repeater stations in tandem and equipped with signalling facilities. These are the two chief types of repeater involved in long trunk cable and aerial systems. The artificial lines with which the repeaters were shown had total transmission losses of 38 and 72 standard miles respectively. The apparatus showed the form and assembly of the company's latest commercial designs, as well as their physical performance.

The repeaters were of the Audion type, using the special valves which have been developed by the company from the forms resulting from the inventions of Dr. Fleming and Dr. Lee de Forest. These thermionic valves have been so greatly improved that they are now as thoroughly standardised as incandescent lamps, have a long life, and can be replaced by spares as readily as lamps. The repeater consists essentially of step-up and step-down transformers and amplifiers, together with potentiometer and regulating resistances and the necessary batteries. The amplifier is of the oxide-coated filament type, having a filament current of 1.2 to 1.3 amperes, plate potential 130 volts, plate current 6 to 12 milliamperes, and grid potential 9 volts negative. The filament works at a low temperature, and the internal structure of the valve is of large size, which facilitates uniformity in manufacture. The average period of service is over 1,000 hours. The valve has a very large margin of energy-carrying capacity over that necessary for transmitting speech without appreciable distortion.

No great difficulty is experienced in repeating conversation in one direction; the difficulty arises when speech, as usual, has to be transmitted in both directions. A simple form of balanced bridge circuit is shown in fig. 2. Energy entering the repeater from the "line west" divides into two parts, of which one goes into the output circuit of the repeater and is there lost, while the other part goes into the input circuit. If the circuit is ideally proportioned, no energy is transmitted *directly* to "line east." The energy entering the input circuit is amplified and fed out into both lines in series, the half going east being the desired amplified transmission.

If the line impedances are not identical, potentials due to the output energy are set up in the input circuit and reamplified, and sustained oscillations called "singing" may be set up, which make the device inoperative as a telephone repeater.

The repeater circuit most commonly used in commercial service is the two-way, two-element circuit shown in fig. 3. Here a separate repeater element is provided for transmission in each direction, and in each bridge circuit each line is balanced by an artificial line called a "network," instead of the other line.

Here again the telephone currents from "line west" divide; the output of repeater element No. 1 is transmitted through the second transformer to "line east," and its balancing network, and if the balance is good, no potentials due to unbalance are applied to the input of repeater No. 2. If, however, the balance is inadequate, such potentials are set up, amplified, and fed back to "line west," and oscillations may be produced.

The 4-wire repeater circuit is a more recent development, which is rapidly coming into commercial use. Two distinct line circuits are required, of which one is used for transmission in one direction and the second for transmission in the other direction. This device grows out of fig. 3 at once if it is assumed that the upper and lower halves of the figure are hundreds of miles apart, so that the four wires connecting them become the four line wires of two lines, each having a repeater element at an intermediate point. Each output transformer is then a junction point between a 2-wire and a 4-wire transmission circuit. Each 2-wire line carries speech energy in one direction only.

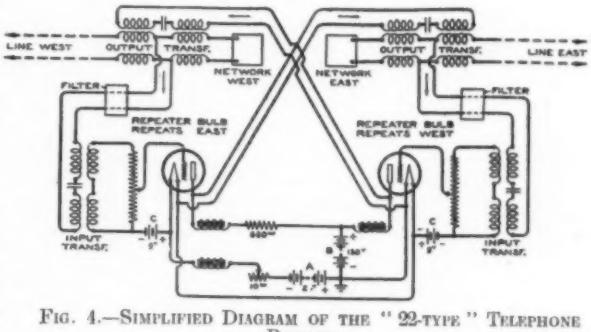


Fig. 4.—Simplified Diagram of the "22-type" Telephone Repeater.

On this system sufficient amplification can be used to annul, theoretically, the whole transmission loss in the 4-wire portion of the circuit, so that very small conductors can be used compared with those necessary for a two-wire transmission, and a much greater gain per repeater is possible.

Fig. 4 shows the general arrangement of the circuits of the repeater.

(To be concluded.)

THE DISTRIBUTION OF ELECTRICITY.

Discussion in London.

On December 9th the adjourned discussion by the Institution of Electrical Engineers on Mr. W. B. Woodhouse's paper, which was abstracted in our issue of December 3rd, and on Mr. R. O. Kapp's paper, which is abstracted on pp. 793-795 of this issue, was continued by Mr. Ll. B. Atkinson, President, who explained a method of finding the final temperature curve of a cable from its load curve squared by mechanical means. The particular instrument used for the purpose was the invention of Mr. Baker, of University College, and had been borrowed from the Imperial College of Science and Technology. The president, after explaining its construction and demonstrating its use, said that there were several similar instruments in existence, some being in the South Kensington Museum.

Mr. C. J. Beaver, referring to Mr. Woodhouse's remarks on H.P. cables, said that it would have been preferable to use the word "advisable" in place of "necessary" in the statement that "a minimum section of 0.05 sq. in. appears necessary for pressures above 10,000 volts." With regard to the limiting factors in the manufacture of large cables, he thought that the weight limit would be reached long before

the liability of cracking the insulation in handling the cable became a serious factor. His opinion concerning an increase of working pressure involving an increased thickness of dielectric, was that for a given voltage the thickness would generally decrease. Further, he could not agree that the permissible current density in a single-core cable designed for a particular pressure must be reduced as the area of the conductor increased; it was rather the reverse. The opinion that present methods of construction limited the size of conductor to 0.25 sq. in. section for the highest pressure, was wrong, inasmuch as they were now making cable of 0.3 sq. in. section. He pointed out the importance of providing a substantial lead covering for such cables as there now was a tendency to cut down the lead sheathing to a dangerous extent. As regarded protective apparatus, the whole conditions had changed, and, therefore, the entire subject required revision. He inquired whether Mr. Kapp had allowed for one or two cables in his figure showing the cost per K.V.A. per mile of 6,600-volt cable, and pointed out that the losses in two small cables would be something like 70 per cent. greater than that in a single larger cable; he concluded by emphasising the importance of research into cable problems.

Mr. P. Dunsheath alluded to dielectric loss problems, and exhibited curves to illustrate the fact that the dielectric loss gradually decreased until a certain point on the curve was reached, when it commenced to rise again. The losses varied in themselves, but they were negligible in comparison with the magnitude of the C^2R losses when considering, say, 33,000-volt cables.

Mr. P. Rosling inquired whether there were any prospects of pressures being standardised. They could easily give the user definite information about the temperatures to which cables would rise, but they could not say anything about what currents they should carry, because they had no idea of the conditions under which the cables would have to work. That was the real difficulty; local conditions under which the cable was laid, temperatures of adjacent objects, such as the earth, other neighbouring cables, &c., influenced the performance of a cable very largely. He suggested that if records of the cable temperature at a number of points along its length were taken regularly and tabulated, the extra work involved would be well repaid by the information that would be made available. Under such conditions the temperature readings would give good indication of how the cable should be loaded up. He thought that the bending test to which cables were subjected was not a good one; it was much too severe.

Mr. S. W. Melsom explained that heating and cooling curves he had prepared himself confirmed Mr. Kapp's assumption that the rates of heating and cooling of cables were equal. He had greatly enjoyed the president's contribution to the discussion because he had tackled the problem of drawing the temperature curve in what might be described as a non-electrical manner. But to arrive at a correct estimate of the temperature of the cable it was essential to have knowledge of the actual local conditions under which the cable operated, and he personally had used an electrical method. He described with the aid of diagrams an instrument which he had devised for the purpose, and expressed the opinion that eventually an instrument would be available which when connected to the cable would record directly on a chart the actual temperature of the core of the cable. They might use thermo-couples in the lead sheath, or even measure the resistance of the sheath; those methods, however, would not give very accurate results on account of the "time lag" which Mr. Kapp had drawn attention to. Messrs. Kapp and Woodhouse had both employed Kelvin's law correctly in their own particular ways, but Mr. Woodhouse had erred slightly in not making sufficient allowance for depreciation of the cable. The temperature was not, therefore, the only factor to be taken into consideration, the questions of the cost of the cable and its depreciation should also be included.

Mr. G. V. Twiss was unable to be present, but sent a written contribution to the discussion in which he took exception to Mr. Woodhouse's statement that "the transmission of electricity is, from an economic point of view, not a virtue but an expensive necessity." It was the right means of realising the full advantages of centralised generation. Among the advantages he claimed for overhead transmission lines were that they would do the same work as and at the same time they were cheaper than cables. Air-insulated, high-pressure, overhead transmission lines would sooner or later come into their own; at the same time each system had its own particular sphere of usefulness.

Mr. G. L. Addenbrooke pointed out that when he was preparing the series of lectures which he delivered before the Institution early in 1919, he found it advisable, indeed necessary, to make a considerable historical survey of the subject. The same could be said with regard to most of the new problems which were presenting themselves for solution. Gordon's book on "Electricity and Magnetism" was an excellent work which had gone out of fashion, but it contained references to Cavendish's and Maxwell's work on dielectrics which Gordon was able to translate into modern language and figures. It was the speaker's opinion that if they were going to attempt to solve the new problems which were cropping up, one of the first things they should do was to refer back to and consult the work of the early workers who, considering the primitive apparatus at their disposal, did really wonderful work.

Mr. H. Brazil, referring to the current-carrying capacity of cables, said that users could not afford to work cables at a current density of 1,000 amps. per sq. in. to-day, and certainly not at the higher figure permitted by the I.E.E. rules. Mr. Beaver had mentioned that it was not long since the Board of Trade had fixed the maximum current in a cable at not more than 1,000 amp., and in America higher temperatures were permitted than in this country. The maximum temperature was the figure with which they should deal, and not the temperature rise. He understood that a ground temperature of 15 deg. F. could be taken as constant, which figure would decrease in the winter time when more current was required to be carried. They should endeavour to fix some more definite figure than they had at present for the maximum temperature; generators and motors were now being run at higher temperatures than they used to be, and there was no reason why cables should not be worked at higher temperatures also. It was a fact that joints could carry much heavier currents than the cables themselves could; they were not the weak spots.

Mr. W. M. Selvey drew attention to several paragraphs in Mr. Woodhouse's paper which, he pointed out, were no less profound because the idea was expressed in simple language. There was the danger of losing sight of the main considerations by devoting too much attention to details. "They could not see the forest for the trees." For instance, the pressure of 2,000 volts which Mr. Woodhouse had introduced in Yorkshire was an extremely useful one, and he had done immense good by making that pressure available for use. There were very few things that could not be done with 2,000 volts, with its high pressure and small current. Motors were obtainable of a small size which would run on 2,000 volts and stand a 20,000-volt flash test successfully. Recently the speaker came across a case where it was proposed to install all the plant in a certain works for a pressure of 500 volts. When he suggested that the public supply would probably be at 400 volts, he was informed that even so the saving in cables that would result from the use of 500 instead of 400 volts would amount to several thousand pounds, and to-day they could not get away from the question of costs. In the statement that: "A number of interconnected stations being assumed, the problem of distribution is much simplified because the transmission mains may be utilised to provide additional feeding points on their routes between stations"—he did not think Mr. Woodhouse intended the words "transmission mains" to convey their usually accepted meaning, because they did not do so. They suffered from a lack of words to suitably express the new meaning which certain terms and expressions were assuming in the new problems which were arising.

Mr. J. R. Beard was interested in Mr. Woodhouse's remarks about a step-by-step development of a distribution system being consistent with economy, and was pleased that he had again emphasised the importance of giving attention to the variation of losses with load factor; it was difficult to convince some engineers that the losses cost as much as they actually did. In his opinion the current density was independent of the working pressure of the cable. The assumption that Mr. Kapp had abandoned Kelvin's law, at any rate for the lower voltages, was not justified. It was necessary to provide protective gear for large interconnected networks; most operating engineers held that opinion, and it was interesting to note that the problem was a British development. Abroad they were only now beginning to realise the economies that resulted from interconnection.

Major A. M. Taylor, who did not speak, has sent us the following remarks which he had intended to make. He was fully convinced that single-phase cables would establish their superiority over three-phase cables. Their use enabled the pressure to be raised from 30,000 to 55,000 volts, and the results of tests which the speaker had made gave him the opinion that working up to a current density of 1,500 amperes per sq. in. the losses in the lead sheathing due to the rotating field were 50 per cent. of those due to the C^2R copper losses, while the losses in the sheathing due to the pulsations in the current were only of the order of 12 per cent. These figures, which were taken at 25 periods, would at least be doubled at 50 periods. With single-phase cables, the losses due to the rotating field would be entirely eliminated, and at 50 periods that would mean, at 1,500 amperes per sq. in., that a loss approximately equal to the whole C^2R copper loss in the cable would be saved. He had also found that the effect of removing the armouring—the figures given above referred to cables without armouring—was to *considerably* reduce the loss due to the pulsations of the current and, therefore, in single-phase cables armouring should certainly not be employed. Clark and Shanklin's tests on unarmoured single-phase cables bore out the tests which the speaker had made as regarded the low losses in the lead sheathing under these conditions. The means adopted, whereby the C^2R losses in the cable were differentiated from those due to the rotating field and the pulsating field, were to note the temperature rise on a given cable under given conditions when traversed by D.C., and then to pass such a three-phase current through the cable as would give exactly the same total C^2R loss in the copper, and again note the rise in temperature in a given time; and lastly, to pass a single-phase A.C. through the cable of the same C^2R copper-heating value, and note the temperature rise under this condition. The tests were very simple to carry out, and appeared to be very conclusive. Incidentally, they

provided a "case" for 25-period long-distance transmission, as against 50 periods.

Mr. W. B. Woodhouse, in reply, expressed pleasure at the assurance that cable makers could tackle the manufacture of higher voltage cables. The standardisation of pressures was at the present time receiving attention. The suggestion that the temperature of a cable should be observed and recorded periodically was a good one, but the economical current density was below that indicated by the heating limit; considerations of cost prevented them from loading a cable up to its full possible limit at the present time. It was erroneous to assume that he favoured the use of low pressures; he had only attempted to warn them against the adoption of the highest possible pressure at the outset—they could not do so at the present price of money. If they were provided with an unlimited amount of money by, say, the Government, they could, of course, do so, but no one would suggest that that was a desirable course to follow. He had no intention of condemning overhead transmission, his idea was rather to explore the possibilities of the use of underground cables.

Mr. R. O. Kapp, in his reply, said that he did not think Mr. Sayers was quite so distressed as some had thought by his (the speaker's) attitude towards Kelvin's law. Even for 6,600 volts that law would indicate a current density of over 2,000 amps. per sq. in., but it was a question of local working conditions, heat dissipation, &c., which considerations also applied in estimating the cost per K.V.A. per mile of 6,600-volt cable. His remarks on the equivalent continuous load would not have been criticised, he thought, had there been no confusion of thought. The heat dissipation influenced the continuous loading considerably, and also the factor of safety; the latter should be a real factor of safety and not one of ignorance or laziness. Protective gear was a misnomer, because it did not come into action until after the fault had developed. It would not be used extensively in the future because of the increased reliability of cables. It was a matter of personal opinion whether the "protection" afforded would justify the expenditure for the provision of the apparatus.

TRAMWAY FINANCE AND STATISTICS.

The White Paper relating to Tramways, Light Railways and Railless Trolley Undertakings, formerly issued by the Board of Trade, but suspended owing to the war since the year 1913-14, has now been compiled by the Ministry of Transport, in respect of the year ended December 31st, 1918, for companies, and March 31st, 1919, for local authorities, and is on sale at the Government Stationery Offices, or may be obtained through any bookseller.

The delay in the re-issue of this Government publication is due to difficulties arising out of the war, many undertakings not being able to complete their accounts within the usual period, following the close of their financial year. Returns for the year ended December 31st, 1919, and March 31st, 1920, are now in hand, and it is anticipated that the White Paper covering this period will be issued early next year.

The White Paper now issued embraces some features which have not hitherto been published. In addition to the net receipts from the operation of tramways, particulars are now given of the income derived from other sources, and the total net income which is available for distribution. The income and expenditure, on revenue account, of tramways which are not worked by the owning companies or authorities are also included for the first time.

The statistical tables have been separated from the accounts and considerably amplified to include for each undertaking the average number of cars in use, traffic revenue per car-mile, miles run per car per day, working expenses per car-mile, fare per passenger, distance passengers are conveyed for each fare, fare per mile, number of units of electrical energy used per car-mile, &c.

The total capital expenditure on tramways in the United Kingdom to the end of the financial year 1918-19 was £82,842,722, an increase of £1,864,884, or 2·3 per cent. compared with the year 1913-14. The total gross receipts during the year 1918-19 were £24,635,266, and the total working expenditure £17,751,277, leaving net receipts amounting to £6,883,989. It must be borne in mind that the maintenance and renewal work undertaken during the year 1918-19 was, owing to war conditions, inadequate, but in spite of this the ratio of working expenses to receipts was 72·06 per cent., as compared with 64·35 per cent. in 1913-14.

The number of car-miles run during 1918-19 was 9·59 per cent. less than in 1913-14, but the number of passengers carried increased by no less than 33 per cent., as shown in the following tables :—

CAR-MILES RUN.

	1918-19. Miles.	1913-14. Miles.	Decrease. Miles.	Decrease. %.
Local authorities	244,162,588	262,675,163	18,512,575	7·05
Companies ...	76,215,788	91,704,509	15,488,721	16·89
Totals ...	320,378,376	354,379,672	34,001,296	9·59

PASSENGERS CARRIED.

	1918-19. Number.	1913-14. Number.	Increase. Number.	Increase. %.
Local authorities	3,632,525,882	2,696,759,064	935,766,818	34·70
Companies ...	925,114,196	729,714,128	195,400,068	26·78
Totals ...	4,557,640,078	3,426,473,192	1,131,166,886	33·01

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Crisis in Electricity Supply.

I shall be obliged if you will allow me to answer a letter written by "Electricity Undertaking," and printed in your issue of December 3rd. Everyone is entitled to his own opinions, however foolish they may appear to others, and I do not wish to criticise the major portion of this letter; the latter remarks, however, concerning junior engineers are, I think, untrue and certainly uncalled for.

It would not be surprising, however, if they were true, for what attraction is there in a profession of which its members, upon attaining the pinnacle of their ambition (mention it with bated breath—"a chief"), promptly desert their less fortunate colleagues and, in fact, use their influence against them? "Electricity Undertaking" says: "Some of the junior engineers in smaller provincial stations should also remember that their training and qualifications are not all that can be desired." These remarks are just what one might expect from a man who, since 1914, has been sheltering behind, and gaining experience in, his profession; whilst the slighted junior members have been gaining their experience in the hell of Flanders and elsewhere. Evidently "Electricity Undertaking" fails to realise that four or five years spent in fighting for one's country is not exactly the best means of gaining additional qualifications in one's civilian calling.

Fortunately, there are some gentlemen in our profession, and they do not endeavour to hinder the progress of their juniors—let us hope that the coming generation will follow their example rather than that set by "Electricity Undertaking."

Junior Engineer.

December 7th, 1920.

[The letter referred to was not written by an engineer.—Eds. Elec. Rev.]

Shop Displays.

Nineteen years! and the electrical contracting industry in a worse state than ever as far as "pirate trading" is concerned. Daily one finds new instances.

Nineteen years! and the influence of any existing organisation unfelt by trade. I do not think that any further argument is wanted for forming a really live combination of contractors to endeavour to put the industry on a proper basis, and to make electrical shops worth while. If the matter could be dealt with by any existing organisation so much the better, but I doubt it. Live men with well-defined aims and a clear conception of the existing evils and their remedy are wanted, and the sooner men of this class get together the sooner will the great possibilities of the industry be developed. The motor-car industry is a much younger one, but it seems to have the trade well protected, and the electrical contractors can do the same.

I certainly think a meeting should be called, and the necessary steps discussed to stop this "pirate trading," and stop "backyard, no-responsibility" men from unfairly trading; to determine who are retailers and who are entitled to a *full* discount; to determine who are purchasers in a large sense and entitled to *some* discount; and when the Association is in working condition there are many other points that require attention, one of which is to see that conditions imposed by trade unions and others are not of a class to throttle the industry. In my opinion, two-thirds of the middle-class work that employed thousands of men before the war has been completely cut off by certain conditions.

There are many other points with which it would not be fair to take up your valuable space. I thank the editors for publishing my two letters, and also for their courtesy in doing so when I raised this subject in pre-war days. The great thing now is for men of the trade to meet.

The Retailer.

London.
December 8th, 1920.

The remarks by "Provinces" in this week's issue amount to this: That if "Retailer" and the like become members of the E.C.A., all our trouble is *over—perhaps!* I think I should be safe in saying that if "Provinces" could conscientiously prove that a successful effort had been undertaken to stop the *unfair* and *injurious* practices at present adopted, the E.C.A. would swell in numbers beyond anticipation. I should be glad to become one of a united body to try and put a finish to the unfair practices that now exist, provided that I could be assured that at least something would be attempted by the united body; and another *bona fide* electrical contractor would join with me.

I myself have been up against men who are wiremen in the daytime, electrical contractors at night; also trade terms given to supposed builders' merchants, ironmongers, &c. Keep the ball rolling; exchange of opinion will do good.

Injured.

The Jurisdiction of the Electricity Commissioners.

In stating (p. 742) that the "Commissioners have no power to authorise a Joint Electricity Authority to supply in the district," has not your legal contributor overlooked Section 12 (3) of the 1919 Act? This section enables the Commissioners to "impose on any Joint Electricity Authority, an obligation to supply electricity in such circumstances, such areas, and on such terms and conditions as to price and otherwise as may be specified in the order."

This seems to meet such a case as your contributor supposes may arise, and, if so, greatly abbreviates his argument.

I may point out, too, that the schedule to the 1899 (Clauses) Act, from which he quotes Section 4 (2), is not exactly a general Act.

Henry M. Sayers.

London.
December 12th, 1920.

With reference to the above letter, our Legal Contributor writes:—

"I am obliged to your correspondent for drawing my attention to S. 12 (3) of the Act, but I had not overlooked it. If he will be so good as to refer to it once more he will find that it begins with the words "Subject to the limitations hereinbefore contained on the powers of a joint authority to supply electricity, &c." One of these limitations is that they may not supply within the area of a power company *without the consent* of that body. This is a matter to which I alluded in an earlier part of my article. That a power company would 'consent' in order to help the Commissioners to act under S. 14 (1) is not very likely.

"As regards the schedule to the 1899 (Clauses) Act, I do not quite know what is meant by the phrase 'a general Act.' The schedule in question is part of a public Act (62 and 63 Vict. c. 19) by S. 1 of which 'the provisions contained in the schedule to this Act shall be incorporated with and form part of every Provisional Order made by the Board of Trade after the commencement of this Act under the Electric Lighting Acts, &c.' Personally, I do not know of any undertakers who are not working under clauses similar to those contained in the schedule referred to. In particular clause 4 (2) is (so far as I know) of general application."—EDS. ELEC. REV.

An Engineers' Club for London.

Your action in opening your columns to a discussion of the need for an engineers' club in London is timely, and likely to be of considerable use. I do not suppose that anyone is more keenly alive to the desirability of promoting social intercourse among members of the Institution of Electrical Engineers than myself, and I regard an engineers' club as one of the best means of effecting this, and also the wider and equally desirable purpose of bringing engineers of all classes together. Because I have taken so great an interest in the matter I am aware of some of the difficulties in the way of achieving the object in view.

First with regard to the use of the I.E.E. building; the value of the space is very high, and in excess of that necessary for the premises of a successful club. Apart from this, even if a portion of the building itself were utilised such portion would have to employ a separate entrance, and be completely cut off physically from the portion retained by the Institution, otherwise a great deal of unnecessary taxation would be incurred by the Institution.

London possesses many clubs attractive for various reasons to different groups of members of the I.E.E. and other engineering institutions, and unless the Engineers' Club could compete on its merits in regard to comfort, cuisine, amenities, and convenience with the first-rate West End clubs, it would have but a poor chance of success. It is no light matter to run a club successfully in London, and even old-established clubs, with their furniture and appointments bought at pre-war prices, and with a large membership, are finding it hard to make ends meet, even with subscriptions increased by 50 per cent. or more on pre-war rates. A new club with furniture and equipment to buy at inflated prices, and with a moderate membership for some time to come, would have to impose a prohibitive subscription if it were to be financially sound.

Finally, there is just a doubt whether the club would be sufficiently supported even if a good club at a moderate subscription could be established. The London engineers cover a much wider range than those in a provincial town, they are not brought so much into individual contact with one another in business, and I greatly fear that the notorious absence of *esprit de corps* among Londoners generally, as compared with provincial citizens, would also militate against success. On the whole, however, I am convinced that an engineers' club for London is a very desirable thing, and I am one of those with whom you associate yourselves in your Editorial note following "M.I.E.E.'s" letter in your issue of the 3rd inst., and believe that, to an engineer especially, the existence of difficulties is and should be an incentive to overcome them. I shall watch the correspondence with interest, and hope that something practical may ensue from it.

C. H. Wordingham.

Westminster.
December 8th, 1920.

An Engineers' Club in London has always seemed to me to be a necessity. I have often asked members of this [Manchester] Club resident in London why they did not form an Engineers' Club in London. The replies have been varied, nearly all being strongly in favour, but one or two were of opinion that all clubable engineers were already members of other clubs, or that London is too large to ensure success.

Since I moved to London it has been my intention to ask the members of this Club resident in London, of whom there are between 50 and 60, to foregather to consider whether an Engineers' Club in London is desirable, and if so, possible. I only received the names and addresses yesterday, and only to-day have seen the letter from "M.I.E.E." in your issue of the 3rd. "M.I.E.E." is not quite correct in his version of the origin of this Club, the official account of which appears in the current book of rules. It was more or less spontaneous, as the want was keenly felt.

If a similar want is evident in London there seems to be no reason why a successful Club should not be formed.

To be successful, it must embrace in its membership all classes and all grades of engineers—civil, mechanical, electrical, mining, chemical, automobile, &c., professional, technical and commercial. This is one of the reasons of the success of the Manchester Club. A purely Electrical Engineers' Club would not, I think, be a success. The difficulties are, of course, great, but so they are in any such project, and I for one would like to see what can be done. The Manchester Club and committee will, I know, be willing to give any assistance which they can, and I believe would like to see some working arrangement whereby membership might be interchangeable between the Manchester Club and the London Club, and it is hoped also between other Engineers' Clubs in each engineering centre.

This must be no parochial effort, but must be strongly supported from all sides before anything is definitely launched. I am writing the members of this Club resident in London to ascertain their views, and shall be pleased if you will add my name to your list of supporters.

H. T. Wilkinson.

Manchester.
December 8th, 1920.

[Replies from correspondents all heartily supporting the proposal continue to arrive, and it has become apparent that the idea has been under consideration in several quarters. We learn from Mr. D. N. Dunlop that a good many members of the Beama would probably support the scheme, and no doubt the action taken by Mr. H. T. Wilkinson, late hon. secretary of the Engineers' Club, Manchester, will bring in many more names. We shall be glad to receive further communications.—EDS. ELEC. REV.]

Under-run Gasfilled Lamps.

Can you give me any information regarding the efficiency of under-run "half-watt" lamps? While vacuum-type tungsten lamps are made for practically any voltage up to 250, gasfilled lamps are only made for standard voltages. To take a case in point: A factory has its own lighting supply at 80 volts, and uses 80-volt, 60-watt vacuum-type lamps. If gasfilled lamps were to be used, the nearest standard size is 100 volts (unless the wiring were rearranged to use 25-volt lamps in series). If 100-volt, 100-watt gasfilled lamps were used on the 80-volt supply, they would absorb about 60 watts each. How would they compare, as regards illumination, with the 80-volt, 60-watt vacuum lamps?

Also, at what percentage of its rated voltage would a gasfilled lamp operate at the same efficiency (in lumens per watt) as a vacuum lamp working at its full rated voltage, and taking the same power as the gasfilled lamp?

Possibly some of your readers may have data on the subject.

Lumen.

A Generator Problem.

A small motor-generator was installed by our company about 12 months ago for kinematograph projector purposes. Shunt wound motor, 480 v., 8.5 a., 1,100 R.P.M., direct coupled to compound, long-shunt generator, 60 v., 50 a. Upon connecting it was found that the generator would not excite; exciting was tried in series with the motor fields, and then in parallel. It was found that the rating 60 v., 50 a., could be obtained by having both fields in parallel. Our customer, having bought this machine second-hand, and not being satisfied with our explanation that it was probably built to be separately excited, called in a consulting engineer, who reported: "Although this machine appears to be self-exciting, it runs satisfactorily separately excited."

I may say that while testing, 240 v. was accidentally switched on this generator, and it ran as a motor.

Recently I was called to this machine for a small fault upon the brush gear, I again tried self-exciting but failed. My problem is, if this is a self-exciting machine:—

1. What is the reason for the compound winding?
2. Why does it run as a motor, and not as a generator?
3. Why not have the fields permanently connected across the bedplate, instead of leaving it to the electrician who installs to loop from terminal boxes?

Wireman.

LEGAL.

Theft from Power Station.

An electrical shift engineer employed by the Warrington Corporation pleaded guilty at the local police court to stealing from the Warrington power station a bicycle, value £4, the property of the Corporation.

It was stated that eight or nine months ago the bicycle, which was used as an emergency machine, to enable men to arrive rapidly at the scene of a breakdown, disappeared from the power station. A notice was exhibited in the works stating that unless it was returned the fact would be reported to the police. Subsequently the bicycle was seen against a wall near the power station, and the police, upon making inquiries, found that it had been sold to a resident of Stockton Heath for 10s. Accused said that the machine was out of use, and he had to fit accessories before parting with it. The Chief Constable said defendant earned from £250 to £300 a year.

A fine of £5 was imposed or a month's imprisonment.

Damages Against Tramway Company.

At Pontefract County Court, on December 7th, the Yorkshire (West Riding) Electric Tramways Co., Ltd., was sued by Louis Green, carter, for £51 damages to a cart as a result of a collision. His Honour Judge McCarthy held that during the time the heavily laden cart—which the complainant said he signalled was about to cross the street—was getting halfway across the tramway driver must have had ample time to pull up his car. The plaintiff was awarded £35 for damage and £1 10s. for expenses in cart hire, with costs.

Extension of Patent.

On December 9th an application was heard by Mr. Justice Sargant in the Chancery Division for the extension of the term of two patents for electrical capstans, in the names of Mr. W. Dixon and Mr. G. H. Baxter, of Glasgow. The patents, Nos. 20,314 and 24,413 of 1904, were both for the same invention, and the inventors joined hands and shared the royalties. Owing to the war manufacture was suspended. No opposition was raised, and an extension of four years was granted.

BUSINESS NOTES.

Christmas Holidays. — Our Advertising Department announces that alterations to existing Trade advertisements (with blocks) for our issue of December 31st, should be received not later than Wednesday, December 22nd.

Bankruptcy Proceedings.—W. H. S. Ward, electrical engineer, 56, High Street, Acton, Middlesex.—The public examination of this debtor was held on December 7th, at the Court House, Brentford. Debtor stated that his liabilities amounted to £851, against assets £275. The Sheriff had taken £150 worth, which had realised £10, while the stock at the date of the receiving order, which had been estimated to realise £75, had produced only £13. He first became aware of his position in August, and in September called his creditors together. The meeting was adjourned for 21 days in order to find out if he could make a cash offer of 5s. in the £. After the meeting he received goods from creditors. The examination was adjourned.

J. Skinner, electric fittings dealer (Foster, Skinner & Co.), 6, South Castle Street, Liverpool.—The public examination of this debtor was held recently at the Court House, Liverpool. The statement of affairs showed liabilities amounting to £1,103, against assets of £147. Debtor stated that he entered into partnership with another gentleman, who provided £400 capital. The partnership was later dissolved, and the debtor agreed to pay his partner £300 in instalments. Less than £40 of this amount had been paid. He was questioned with regard to a retail business started on behalf of his wife. The Official Receiver said that there must be a further investigation, and the accounts must be amended. The examination was adjourned.

J. W. Layton, electrician, 5, Nobles Bank, Hendon, Sunderland.—First meeting, December 17th, at Official Receiver's offices, Sunderland. Public examination, December 23rd, at the Court House, Sunderland.

Company Liquidations.—Cannor Motor and Electrical Works, Ltd.—Meeting of creditors, December 20th, at 46, Old Steine, Brighton. Liquidator, Mr. P. George.

Electrical Engineering Society, Ltd. (late Electrical and Mechanical Co-operative Trading Society, Ltd.).—Meeting of creditors, December 21st, at 5, Cook Street, Liverpool. Particulars of claims must be sent to the liquidator, Mr. A. J. Glass, 5, Cook Street, Liverpool, by January 17th, 1921.

Westinghouse Electric Co., Ltd.—Meeting of members is called for January 17th, 1921, at 4, Central Buildings, Westminster, S.W., to hear an account of the winding-up from the liquidator, Mr. A. E. Scanes.

Dissolution of Partnership.—Howarth Bros. and Worth, electrical and motor engineers, 457A, Stockport Road, Longsight, Manchester.—Messrs. A. and E. Howarth and P. J. Worth have dissolved partnership. Mr. A. Howarth will attend to debts and continue the business.

Catalogues and Lists.—The Piggott Conduits and Cable Co., 24, New Bridge Street, E.C. 4.—A leaflet giving a fully priced and detailed list of D.C. motors for sale.

Hick Diesel Oil Engines, Ltd., 70, Queen Street, E.C. 4.—An illustrated leaflet giving particulars of the "Ballot" 1-kw. electric lighting set.

London Electric Stores, 39, Furnival Street, Holborn, E.C. 4.—Price list (8 pp.) of electrical accessories, including adapters, bells, cable, cut-outs, dry cells, fuseboards, switchgear, &c.

John Armstrong & Co., Lancaster Buildings, Barton Square, St. Ann's Street, Manchester.—A blotter bearing a black and white design which embodies illustrations of generating sets, a motor, an electric fire, &c., typifying the various classes of work carried out by the firm.

Tomlinson-Haas, Ltd., 6, St. Mary's Gate, Manchester.—An illustrated pamphlet giving an illustration and details of the "Simplex" drying machine in which the fan is the only moving part.

The Stanton Ironworks Co., Ltd., near Nottingham.—Monthly stock list of cast-iron pipes with full dimensions and weights. Illustrated by photographs of works.

The Edison Swan Electric Co., Ltd., Ponder's End, Middlesex.—Catalogue Section A. A well-illustrated price list of X-ray coils, transformers, interrupters, switchboards, &c.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.—Leaflet No. O 2.275, illustrating the new "Handilite" magneto flash lamp. Also Folder No. H 2,387 illustrating the adaptability of the "Magnet" pedestal heater to various uses.

Bilbie, Hobson & Co., 106, Queen Victoria Street, E.C. 4.—An illustrated descriptive catalogue (16 pp.) of "Monitor" patent safety devices for gas and oil engines, air compressors, pumping machinery, &c.

W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, E.C. 2.—List W.A. 1. A well-illustrated price list (26 pp.) of distribution pillars (unit type) and components; includes various arrangements of glands for use with sealing chambers.

Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W. 1.—Publicity matter dealing with Siemens's dry battery lighting sets, including Leaflets 538 A—for side-car lamps and rear lamps on motor bicycles, 538 Q—for bicycles, and a show-card in dull red, black and white, illustrating the sets applied to various vehicles. The leaflets are fully illustrated and priced.

The British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C. 4.—Two illustrated and priced folders, one dealing with "Tungar" rectifiers (Elec. Rev., 17/9/20, p. 382), and the other with the "Pyrotip" electric lead burners (Elec. Rev., 23/7/20, p. 122).

Trade Announcements.—Capt. W. H. Marshall, consulting and mechanical engineer, 2, King's Terrace, Portsmouth, will be glad to receive catalogues and price lists of electrical plant and apparatus, also of steam plants, oil engines, &c.

The Hillbar Press, 72, Finsbury Pavement, E.C. 2, announces that it has installed a complete box-making plant for the dry battery and accumulator trades, and can deliver all cartons used by these trades immediately.

The new showrooms of the Edison Swan Electric Co., Ltd., at 33-35, School Lane, Liverpool, were opened on Dec. 6th. A very representative gathering of contractors was present, all of whom expressed their satisfaction with the arrangements of the new premises. These showrooms are purely for the "trade," and private customers can only make use of them upon an introduction from their contractors.

Foreign Trade.—November Figures.—The following are the values of imports and exports of electrical goods and machinery in November :—

	November. 1920.	*Inc. or dec.*	11 *months*, 1920, *Inc. or dec.*
Imports.	£	£	£
Electrical goods, &c. ...	243,308	+ 193,549	+ 480,638
Machinery	1,608,418	+ 822,766	+ 4,925,977
Exports.			
Electrical goods, &c. ...	1,218,698	+ 534,136	+ 5,187,858
Machinery	7,788,243	+4,307,348	+28,970,440
Re-exports.			
Electrical goods, &c. ...	14,915	+ 10,467	+ 44,469
Machinery	164,740	+ 56,888	+ 721,121

Brussels.—Commercial Fair, 1921. — The second official commercial fair at Brussels is fixed for April 4th to 30th, 1921, and will be held in the Park and at the Halle du Cinquantenaire. Group 8 is reserved for the electrical industry (apparatus, heating, lighting, motive power, telephony and telegraphy). Group 4 will be devoted to the metal working and mechanical industries, and Group 24 to instruments of precision. 1,602 firms took part in the first fair, and it is expected that the second will repeat the former success.

Book Notices.—"*Transactions* of the South African Institute of Electrical Engineers." Vol. XI. Part 10. October, 1920. Price 2s. Includes "Notes on the Electrical Equipment of Johannesburg Municipal Tramways," by Mr. L. Ralston, several discussions on other papers, and accounts of proceedings.

"*Journal* of the South African Institute of Engineers." Vol. XIX. No. 4. November, 1920. 20 pp. Includes a paper on "New Shaft and Development Lay-out at Randfontein Central, &c.," by G. H. Beatty, and discussions of previous papers.

"The Metropolitan-Vickers Gazette." Vol. V. No. 92. November, 1920. A number of interesting articles appear in the present issue of the "Gazette," including notes on developments of the Trafford Park Works, Manchester (illustrated); "A Few Considerations on Continental Switchgear Practice" (illustrated); "Three-phase Transformers for Rotary Converters with Reactance Control"; "The Measurement of the Slip of Induction Motors," &c.

"Unity," the organ of the National Alliance of Employers and Employed. Vol. II. No. 23. 16 pp. Price 2d. The cover of the present issue bears a map of England and Wales showing the divisions in which the various federations act. Notes and articles by a number of labour leaders and employers make very interesting reading.

Scientific Paper No. 395 of the U.S. Bureau of Standards, "Relation of the High-Temperature Treatment of High-Speed Steel to Secondary Hardening and Red Hardness." (16 pp.) Washington: Government Printing Office. Price 10 cents. Accounts of experimental work illustrated by photographs.

"Electrical Scientific and Telegraph Instruments of British Manufacture." Pamphlet issued by the British Electrical and Allied Manufacturers' Association on behalf of the Scientific and Telegraph Instrument Section ("Beama Satis"). Free to overseas technical colleges, on application to the Association.

The European Glow-Lamp Convention.—During the course of the war a price convention was formed between makers of glow lamps in European countries in order to prevent dumping from one country into another at prices below the cost of production. The convention was composed of German and Dutch makers, Austro-Hungarian firms, and makers in other countries, and had a currency of six months, which was renewable. Apparently the convention has been renewed on various occasions in the past, and it has now, it is stated, again been prolonged for six months.

A District Joint Board for Technical Staffs.—At a meeting of the Home Counties (No. 9 Area) Joint Industrial Council held on December 8th, at the Ministry of Labour, it was resolved that a District Joint Board should be set up for the purpose of dealing with matters relating to the conditions of employment and remuneration of technical staffs. The following gentlemen were elected to act as the employers' side of the District Board:—

Municipal:—Alderman A. Wilkinson, Luton; Alderman Geo. Radford, Southend; Councillor Legg, J.P., Reigate; Mr. R. N. Torpy, M.Inst.C.E., borough electrical engineer, Tunbridge Wells; Mr. Robt. W. L. Phillips, borough electrical engineer, Bedford; Mr. C. A. Blascheck, chief electrical engineer, Canterbury.

Company:—Messrs. G. W. Spencer Hawes, Reading Electric Supply Co., Ltd; T. Hesketh, Folkestone Electricity Supply Co.; J. Eustace, Electric Supply Corporation, Ltd.; W. E. Brandreth, Wycombe (Borough) Electric Light and Power Co.; A. J. Wray, Banbury and District Electric Supply Co.; G. W. F. Horner, Leatherhead and District Electricity Co.

Excess Profits Duty.—The United River Plate Telephone Co., Ltd., having made application to the Commissioners of Inland Revenue for an increase of statutory percentage as regards the business of supplying telephone service in the Argentine Republic, the Board of Referees has ordered that the statutory percentage shall be increased:—

(1) In the case of any trade or business carried on or owned by a company or other body corporate to 8 per cent.

(2) In the case of any other trade or business:—

(*a*) For accounting periods ending prior to January 1st, 1917, to 8 per cent. plus 1 per cent.

(*b*) For accounting periods ending after December 31st, 1916, to 8 per cent. plus 2 per cent.; except that for the purposes of Sub-Sec. (2) of Sec. 41 of the principal Act the statutory percentage shall be 8 per cent. plus 1 per cent.; with the addition, in cases 1 and 2 (*b*), for the purposes of Sub-Sec. (1) of Sec. 41 of, and paragraph 4 of Part II of the Fourth Schedule to, the principal Act, of 3 per cent. for accounting periods ending after December 31st, 1916, and before January 1st, 1920, and of 5 per cent. for accounting periods ending after December 31st, 1919.

New Company Law in Greece.—The Commercial Secretary to H.M. Legation at Athens has forwarded a copy of the Greek Government *Gazette* of September 19th, containing Law No. 2,190, concerning limited companies in Greece. A translation of the Law accompanies the Government *Gazette*, and both may be consulted on application to the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W. 1.—*Board of Trade Journal.*

A Trade-Union Grievance.—Under this heading, Mr. Will Thorne, M.P., contributes an article to "Unity," showing that under the Trade Union Amendment Act of 1917, Trade Unions are prevented from combining unless recording a 20 per cent. majority in favour of amalgamation when 50 per cent. of the members of the Unions concerned are voting. On the other hand, the amalgamation of big business concerns, tending to the diminution of competition, is not barred by special legislation. He states that such obstacles placed in the way of Labour do not tend to make for peace between the two chief factors of industry.

An Ediswan Concert.—The Ediswan Staff Association, which is under the patronage of the managing director, Mr. C. E. Hunter, and one of the directors, Mr. E. A. Gimingham, has now been in existence about 18 months, and is making great efforts to fulfil the object for which it was formed—to promote social intercourse between the members of the staff. A series of whist drives, concerts, &c., has been arranged for the winter months, and a concert was held on December 4th at St. James's Hall, Ponders End, when an excellent programme was provided by "The Mauves," a concert party consisting of members of the staff. The hit of the evening was undoubtedly the burlesque of a music hall, with its caricature impressions of series, comedians, &c., and a thrilling drama, "Darkness to Dawn." Other items deserving of mention were the songs of Miss M. Young, the duets of Miss E. Barker and Mr. L. Winterflood, the recitation of Miss A. Barker, and the fine singing of Mr. S. Barker. The broad comedy side was well handled by Mr. E. C. Pembury.

New French Companies.—Under the style of Bouillat et Dumadieu there has been formed at Lyons (11 bis, Chemin de Saint Gervais) a company, with 170,000 fr. capital, for the manufacture of electrical heating apparatus.

At Montreuil-sous-Bois has been embodied as a company Coutelier et Cie., with a capital of 140,000 fr., for the working of a porcelain factory for electrical products and kindred uses. Its offices are at 94, Boulevard Arago.

There has been formed at Paris (28, Avenue Felix-Faure) the Société Régionale de Distribution d'Electricité, with a capital of 600,000 fr., for the study, installation, and working of electric distribution installations for public bodies or private individuals, and other kindred operations.

With a capital of 125,000 fr. the Mécanique et Electricité Industrielles has been embodied as a company at Paris (11, Rue Saint Fargeau) for objects indicated by its title.

Electricity Supply Rifle League.—The following are the results of the matches in November:—Central, 562—Hackney, 533; Metropolitan, 579—City Co., 578; Brompton, 570—Metropolitan, 566; Shoreditch, 580—Hackney, 542; Shoreditch, 583—Brompton, 561; Brompton, 571—St. James's, 548. The positions of the teams are as follows:—Shoreditch, 24 points; Metropolitan, 20; City Co., 16; Central, 16; Brompton, 10; Hackney, 10; Hampstead, 4; St. James's, 2; Poplar, 2. The eighth annual distribution of prizes and concert took place on December 3rd, at the Town Hall, Hackney, preceded by a whist drive. Councillor E. A. Little (vice-chairman of the Electricity Committee) presided, supported by Mr. L. L. Robinson, M.Inst.C.E., borough electrical engineer. The following prizes were presented: May Cup and Club Championship, A. G. Hilling; Mayor's Cup, C. Turner; Bottomley Shield, E. Mathews; *John Bull* Cup, A. T. Atkins; Smith Trophy for ex-service men, A. G. Hilling; Robinson Cup, W. F. Harrison; League Cup, E. S. Marriott; Disk Competition, H. D. Pratchett; Bell Medal, H. D. Pratchett; Roberts Medal, H. D. Pratchett; *Daily Express* Medal, W. F. Harrison; *Daily Telegraph* Certificate, H. D. Pratchett; *Daily Mail* Certificate, W. F. Harrison.

Australian Customs Judgment.—The Melbourne High Court judgment in the case, on December 6th, of Stewarts v. The Customs Department, laying down that the calculation of duty on foreign goods should be based on the commercial rate of exchange, and not on the par value of the currency of the country of origin, is expected to have a far-reaching effect, as many importers of goods may claim refunds of duty paid.—*Reuter's Trade Service* (Melbourne).

Deed of Assignment.—C. W. Dixon, electrical engineer, 1A, Clark's Buildings, Shaftesbury Avenue.—Claims must be sent to the trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., by December 23rd.

New Spanish Company.—The Sociedad Electrica de Orense has been formed at Bilbao, with a capital of 1,500,000 pesetas, for the generation, supply, and distribution of electrical energy.

Debts to Germans.—In reply to questions in Parliament, Lord Somerleyton, for the Board of Trade, stated that the German Government had paid about £9,000,000, which had been used in paying to British creditors their debts at pre-war rates of exchange. In addition, the proceeds of the sale of British property which was liquidated in Germany during the war had been remitted to the amount of over £5,000,000.—*The Times.*

A New Belting.—Messrs. Dieny & Lucas, 329, High Holborn, W.C. 1, send us a report of tests made at the National Physical Laboratory upon samples of "Pieuvre" belting—the invention of a Frenchman, M. Henri Guillon. For each belt the coefficient of friction was determined for three values of the maximum tension in the belt corresponding to the values of 42, 75, and 115 lb. per inch of width respectively. The results given are very high compared with the values for most, or all, other types of belting.

Industrial Content.—We have received from the Industrial Publicity Bureau, Penarth, Cardiff, a booklet bearing the above title addressed to industrial managers, recommending to their attention a series of "Pay-Day Talks," the first of which is enclosed. No. 1 is a talk upon the present chaotic state of Russia, with reasons for it.

Inquiry.—Makers of china parts for electrical accessories are asked for.

Electrical Plant in New Zealand.—His Majesty's Trade Commissioner in New Zealand (Mr. R. W. Dalton) has on many occasions drawn attention to the rapid electrical developments in various parts of New Zealand, and to the increasing application of hydro-electric power to various industrial and commercial uses. He also points out that in view of the large number of such small schemes (that is, up to £50,000 in value) the amount of business represented by contracts is considerable in the total, but the time given for tendering is often too short to allow of offers being sent from home. It is, therefore, highly desirable that firms should have proper agents who can tender on the spot in New Zealand, as American firms are well placed in this respect, and a good deal of business in the smaller contracts is going to America in consequence.

The Department of Overseas Trade (35, Old Queen Street, Westminster, S.W. 1) is in a position to supply names of agents in New Zealand, and any United Kingdom firms not already represented in that Dominion, who may desire to act on the above suggestions, are invited to approach the Department upon the matter.

A Suburban Electrical Exhibition.—Last week an electrical exhibition was held at "Electric House," 184, Peckham Rye S.E. 22, where Mr. W. M. Williamson established offices and showrooms a year ago. The exhibition was opened to the public for a week, and many thousands of invitations were circulated in advance. An excellent display of electrical apparatus had been got together, covering practically the whole range of domestic applications of electricity, and comprising, therefore, a great variety of lighting fittings, various types of radiators, electric irons, fans, suction cleaners, washing machines, cooking apparatus, the Tungar rectifier, bed-warming devices, &c. Demonstrations of the uses of these apparatus were given, and on the occasion of our visit, it was clear that the public were keenly interested in the exhibits. Mr. Williamson, who is an electrical engineer and contractor, has used electric lighting, heating, and cooking in his own house for many years, consuming only about four tons of coal a year, although he has a large family; he is, therefore, well qualified to testify to the advantages of electrical methods. We tender him our hearty congratulations on his enterprise and on the admirable collection of interesting apparatus which he brought together, and trust that the results will prove as gratifying as he could wish. We venture to commend this praiseworthy example to the notice of other contractors; exhibitions of this kind should go far towards educating the local residents with regard to the comforts and convenience of the electric house.

Lead Report.—Messrs. G. Cawson & Co. report (December 11th):—

"The lead market this week has continued unsatisfactory, and prices after opening fairly steady have sagged all round. Arrivals during the week have been fairly heavy, in fact, heavier than the market could comfortably digest. Some lead arriving rather unexpectedly, and sooner than was anticipated, sold down to £25. Furthermore, it is a very bad time in the year to have unsold arrivals coming on the market, as consumers endeavour to clear their stocks at the end of December, and to carry as little as possible into the new year. Closing prices are:—Prompt and December, £25 10s. to £25 15s.; January, £26 to £26 5s.; February and March, £26 5s. to £26 10s."

Messrs. James Forster & Co. reporting on December 11th, say:—

"On Monday's market the only business done was for March at £27 to £27 10s., with buyers over at £27 5s. The next day values were 10s. lower for all positions, December selling at £26 5s., and March at £26 15s. On Wednesday the tone was somewhat firmer, December selling at £26 5s., and March at £27. Thursday and yesterday, however, were again easier, the close being slightly firmer at above figures. Consumers have bought little or nothing, the bulk of the business done being professional. Board of Trade Returns for November are:—Imports, 17,279 tons; exports, 3,934 tons; leaving 13,345 tons for home absorption. The total available for home consumption for the 11 months January 1st to November 30th, was 81,382 tons—a monthly average of 7,400 tons. There can be no question that the consumption in this country is far in excess of this figure. General conditions are too unsettled to expect anything like steady markets, but for the present, at any rate, it looks as if we may have a recovery in lead values."

A Lock for Gasfilled Lamps.—Messrs. Lamlok, Ltd., inform us that they have now devised, and are putting on the market, a slight variation of the well-known Lamlok ring to suit certain types of G.E.S. holders, thus preventing large gasfilled lamps with G.E.S. screw caps being removed from their holders. Details will be published within a few weeks.

Electricity Supply Commercial Association.—The West of England Division of the Electricity Supply Commercial Association held their annual meeting, on December 10th, at Bristol. The meeting was preceded by tea, and there was a splendid attendance of members. Mr. A. N. Allen (Gloucester) having resigned the secretaryship of the Division, was heartily thanked for his whole-hearted services during the past two years, and Mr. C. Hancock (Bristol), was elected to fill the vacancy. The following members have been elected to the Divisional Council for the ensuing year:—Messrs. R. H. Morris (Bath), A. N. Allen (Gloucester), Tripp (Cornwall), Toutt (Plymouth), W. Hounsell (Minehead), T. H. Gait, C. Hancock, E. Macvitie (Bristol), W. P. Short (Taunton), and Miss Radford (Bristol). The business meeting was followed by a musical programme arranged by the Bristol members, and a most enjoyable evening was spent

Catalogues for Reval.—The Department of Overseas Trade informs us that H.M. Consul at Reval suggests, in a recent dispatch, that United Kingdom firms interested in trade with Esthonia might find it useful to forward copies of their catalogues to the British Consulate for use in dealing with inquiries as to the names of manufacturers and suppliers of particular goods, and for distribution amongst the leading local firms and the Manufacturers' Association in Reval. The Consul states that the Consulate is well supplied with particulars as to the goods British firms can offer, but very few catalogues with details from the firms themselves are available. Catalogues should be addressed to His Majesty's Consul, British Consulate, Reval. The Department would like to be notified of any action taker.

Esthonian Trade Credits.—Gold specie to the value of £500,000 arrived in this country from Reval, on the 9th inst., being consigned by the Bank of Esthonia to the Bank of England for the purpose of establishing trade credits in this country.

Three-Shift System.—The arrangements made at a special conference between the Engineering and National Employers' Federation and representatives of the Amalgamated Engineering Union, which terminated at York last week, with reference to the inauguration of a shift system for the absorption of the unemployed in the industry, provide that it shall be applicable nationally, but that the system will be the subject of consultation with the Works Committees in each case. Each shift is to have a half-hour break for a meal. The first shift's week will consist of 43 hours, for which 47 hours will be paid; the second of 37½ hours, for which 47 hours will be paid; and the third of 37½ hours, for which 50 hours will be paid.—*The Times.*

The *Daily Herald* states that a body of 100 Woolwich unemployed marched to the Western Electric Co.'s works at North Woolwich to press for the introduction of the three-shift system, as a means of absorbing some of the unemployed in the district. The men, after being conducted over the factory, were informed that, owing to an accident to a power generator, some of the machinery could only be used at night, with the result that the company, though in favour of the three-shift system, could not put it into force at present.

Applications for British Trade Marks.—In our issue of December 23rd, on p. 719, the word "Sartax" appears under this head; this is incorrect, and should read "Saitax."

"Cooperite."—Mr. Sydney Wertheimer, secretary of Zirconium Alloys Syndicate, writes to *The Times* with reference to "Cooperite," a new cutting medium for machining metal, an account of which appeared in the daily Press last week:—"It is not the property of any Sheffield firm, but is owned by the Zirconium Alloys Syndicate, of 64, Victoria Street, Westminster. An official test was carried out at works in Sheffield on November 30th, where the tools were manufactured, and one of these tools was tested at the Sheffield Testing Works, Ltd., on December 1st, in the presence of technical representatives of interested firms, and my syndicate, with the result that our Cooperite tool at the same feed and speed removed the same weight of material per minute from a steel bar as the best high-speed steel, but whereas the high-speed steel tool was done up in 2 minutes 20 seconds, our Cooperite tool lasted 21 minutes 21 seconds."

International Patents Convention.—The Rumanian Government has signified its adherence to the international convention for the protection of industrial property as relating to trade marks and patents.—*Financier.*

New Italian Electrical Companies.—There has been formed at Milan a company, styled Officine Meccaniche Tessari e Roux, for the manufacture of electrical and other apparatus. Its capital is 1,000,000 lire.

The Anonima Italiana Materiale Elettrico is the title of a company established at Milan (Corso Venezia, 14), with a capital of 250,000 lire, as electrical agents.

At Novi Ligure has been established the Società Anonima Radius, with a capital of 150,000 lire, for the manufacture of electric lamps.

With a capital of 250,000 lire the Società Anonima Materiale Elettrica has been launched at Milan for the representation of the Ohio Brass Co., of Mansfield, U.S.A.

At Milan the Società Anonima Splendor has been embodied, to trade in the Arno patents for electrical and mechanical apparatus. Capital, 200,000 lire.

There has been constituted at Rivello the Società Idroelettrica Rivellese, with a capital of 1,000,000 lire, for the production and distribution of electric energy.

At Turin a company has been established, Fratelli Mosso e Ca., with a capital of 250,000 lire, for electrolytic production.

The Società Italiana Pubblicità Luminosa S.I.P.L. has been registered at Turin, with a capital of 125,000 lire, for the utilisation of electric apparatus for the display of written luminous phrases.

With a capital of 375,000 lire, the Società Contatori Elettrici di Ing. Falco, Vitale e Ca. has been constituted at Turin for the manufacture of electric and other meters and instruments of precision.

Patents in Greece.—A copy of a Law (No. 2,527) relative to Patents in Greece, published recently in the Greek Government *Gazette*, may be consulted by United Kingdom firms interested on application to the Inquiry Office of the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W. 1.—*Board of Trade Journal.*

The Crisis in Electricity Supply.— In a long letter received too late for our last issue, Mr. W. A. Jones, general secretary of the Electrical Power Engineers' Association, replied to some of the points raised in the letter from "Electricity Undertaking," which appeared in our issue of December 3rd. The following are extracts from the letter:—

In the first place, we desire emphatically to demur to your correspondent's statement that the National Joint Board is a self-constituted body. As a matter of fact, it was set up with the cognisance, and in many cases, with the definite approval of the electricity undertakings throughout the country, and of the various associations which represented them.

The E.P.E.A., in view of its failure to secure representation on the N.J.I.C., was pressing for the formation of a separate Whitley Council for the technical staffs, and finally it was agreed, on the advice of the Ministry of Labour, that a National Joint Board should be formed consisting on the employers' side of representatives of the four Employers' Associations. That this board was not set up without the consent of these associations can be amply demonstrated. On December 30th, 1919, a letter was received by the E.P.E.A. from the secretary of the I.M.E.A. intimating that the Council of the I.M.E.A. approved of the formation of an Industrial Council representative on the employés' side of those members of the staffs "*who are not eligible for representation on the trade union side of the existing Joint Industrial Council,*" and authorising the I.M.E.A. representatives to serve on the National Joint Board.

On March 10th, 1920, a letter was sent to all undertakings notifying them of the constitution of the board, and recommending them to agree to accept the findings of the board on all questions affecting members of the staff. Many undertakings replied in the affirmative; some, however, ignored the communication. This, in the case of the members of the I.M.E.A., was followed on April 15th by a circular letter explaining the procedure which had been adopted in the setting-up of the Joint Board, and specifically stating that the board was considering matters relating to salaries and conditions of employment. The circular concluded that "the recommendations of these bodies should be considered as more or less morally binding on undertakings belonging to this Association."

It is not necessary to go any further and reiterate the statement regarding the resolution which was unanimously passed at the annual meeting of the I.M.E.A. on June 21st. Sufficient has been said to show conclusively that it is quite inaccurate for undertakings to plead at this time of the day, that "they were not consulted and had no voice directly, or indirectly, in drawing up the schedule, nor knew that it was being prepared." They certainly had an opportunity of making their wishes known, and if they did not choose to avail themselves of it, the responsibility does not lie at the door of the E.P.E.A.

With regard to his contention that the length of service is not taken into account in the schedule, we would remind him that the figures laid down are *minimum salaries*, and there is no reason why undertakings which consider that length of service should be rewarded should not make suitable increases to the schedule figures.

We are sorry to note that your correspondent takes up the position that it is doubtful whether undertakings are likely to permit of interference by outside bodies. Surely he must recognise that so long as salaries and wages are determined as they have been in the past, solely by the unregulated operation of the law of supply and demand, or by individual bargaining between the staff and the employer, strikes will become the usual feature in the supply industry and not the exception.

The tilt which your correspondent makes at the doubtful qualifications possessed by junior engineers in the smaller stations is very superficial. It must surely have occurred to him that the deterioration in the personnel in the electricity supply industry—the truth of which no one will deny—has been almost entirely due to inadequate remuneration. Is it to be wondered at that efficient and highly trained men cannot be secured at the intolerably low salaries usually offered by such undertakings?

The Secretary of the Ministry of Labour makes the following announcement:—

The National Joint Board (Electricity Supply Industry) met representatives of the Ministry of Labour, on December 13th, and intimated that the following resolution had been adopted:—"The National Joint Board having done all that is possible to secure the acceptance of the schedule, and having obtained the adherence of undertakings supplying upwards of 90 per cent. of the total electrical output of the country, decide to report to the Ministry of Labour that there are still certain undertakings which have not accepted the schedule, and to ask the Ministry to enter into negotiations with respect to these undertakings." In accordance with this resolution the representatives of the Ministry of Labour subsequently met the Executive of the E.P.E.A., when it was agreed that, as the Ministry are about to enter into negotiations with the outstanding undertakings (negotiations which would necessarily occupy time, the E.P.E.A. should suspend the notices against these undertakings, pending the negotiations. So far as regards the undertakings that have already accepted the schedule in its entirety, and those undertakings which, as a result of the negotiations, also accept the schedule, it was agreed that the Ministry might intimate that the notices against such undertakings are withdrawn. Arrangements will now be made to hold conferences under the auspices of the Ministry for the purposes of the further negotiations.

The latest information received from the E.P.E.A. indicated that 180 undertakings had accepted the schedule. Meetings were being held under the auspices of the Ministry of Labour, on December 16th, for the dissenting provincial undertakings, and on December 20th for those in the Greater London area.

Mr. Norman Wyld, general secretary of the Society of Technical Engineers, in a letter to *The Times*, while expressing sympathy with the aims of the E.P.E.A., considers that the employers' side of the Joint Board was armed with incomplete authority and, in the case of the municipalities, unnecessarily incomplete.

Deflation in the United States.—In the *Board of Trade Journal* for November 18th H.M. Ambassador at Washington describes the commercial and industrial situation in detail. After recounting the series of reductions in prices which have taken place during recent months in connection with food and clothing, &c., he states that unemployment has not yet grown to large enough dimensions to constitute a serious problem, but the possibility of its extension appears to be producing a sobering effect on labour, the strike record shows comparatively few disturbances, and the general labour outlook at the moment seems to be not too unfavourable. There is, as yet, no tendency on the part of manufacturers to force wages down. It would probably be impossible for them to do so until the cost of living has substantially decreased, and it must be remembered that the decline in prices has, so far, been confined, in the main, to transactions at wholesale. Nevertheless, the general trend of things is towards lower wage rates, and by next spring new contracts at lower figures may be possible.

U.S.A. Trade Aims. — Mr. Colby is asking Congress for an increase of nearly £600,000 in the appropriation for the State Department, says the *Daily Mail*, which explains that the United States is finding itself in keen commercial competition with other nations which, reviving after the war, are intensifying their efforts to gain fresh foreign markets, to seize the markets formerly controlled by enemy Powers, and to attain a higher degree of economic production, and that, therefore, an adequate staff of technical experts is needed in the foreign service of the United States. Formal steps are being taken in Chicago for the formation of a Foreign Trade Financing Corporation under the Edge Law (introduced by Senator W. E. Edge to stabilise the exchange), with a capital of £25,000,000, the object of which will be to reorganise the American export trade, now stagnant through the inability of European countries to pay for the goods they require from this country. It is proposed on the basis of the authorised capital to issue £250,000,000 worth of debentures covered by securities transferred to the corporation by foreign purchasers of American goods. The same journal announces that over 200 bankers assembled at Chicago and launched the organisation on December 11th, and states that the corporation is backed by some of the greatest American financers, and will, it is understood, be ready to begin operations by the New Year. The report of the organising committee is somewhat significantly worded. It is recommended, for instance, "that the extension of credit by the corporation be confined to countries where there is stable government and where there is an assurance of integrity of purpose," with the further proviso that the operations of the corporation be limited "to financing for the benefit of the future foreign trade." The committee appointed to supervise the floating of the corporation includes Mr. Herbert Hoover, Mr. John McHugh, chairman of the Marine Commerce Committee of the American Bankers' Association, Chas. H. Sabin, president of the Guaranty Trust Co., and Mr. Paul Warburg.

Trade with the Argentine Republic.—According to information received in the Department of Overseas Trade, from H.M. Commercial Secretary at Buenos Aires, it is announced by the Ministry of Public Works that in all departments of the Ministry, registers shall be compiled of local firms known as importers, or makers of, or dealers in, materials of the kind usually required by the various departments, so that each firm may be invited to present offers in cases of private calls for tenders. As regards public invitations for tenders, it will be necessary for each offer to be accompanied by a public document proving the right to represent the firm concerned in any case where the firm itself does not directly make an offer. This measure has been taken owing to cases having occurred of two parties offering goods manufactured by the same principals. These decisions affect offers which may be made to offices under the control of the Ministry of Public Works only.

Wages in Australia.—The recommendations of the Federal Basic Wage Commission provide for a minimum wage which varies in the different capitals of the Commonwealth. The highest is that proposed for Sydney, where the weekly minimum wage suggested is £5 17s., and the lowest is that for Brisbane £5 6s. 2d. If put into force these recommendations will increase the wages bill of the Commonwealth by from 70 to 100 millions sterling, the present weekly average wage being £3 15s. Employers and the Government are alike gravely concerned, and it is believed that a modification of the recommendations will be sought.—*Reuter's Trade Service* (Melbourne).

A Cricket Club Dinner.—The annual dinner of the Elliott Cricket Club (Elliott Bros., Ltd.) was held on December 10th. The president of the club (Mr. L. W. Smith) occupied the chair, supported by Sir Keith Elphinstone, K.B.E. (vice-president), and Mr. E. J. Griffin (chairman of committee). After full justice had been done to the excellent repast put before the company by the hostess, Mrs. Baker, the toasts of the evening were honoured. During the evening the musical programme was well sustained by Messrs. W. E. Currans, Bert Jones, E. J. Griffin, W. Nicolle and various members, while Sir Keith Elphinstone delighted the company with his Scotch yarns.

For Sale.—By order of the Disposals Board, Ministry of Munitions, Mr. C. D. Phillips will sell by auction, on Tuesday, January 11th, at the Subscription Rooms, Stroud, Gloucestershire, and on Wednesday, January 12th, at No. 86, C.S. Depôt, Rotherwas, Hereford, a quantity of machine tools, several generating sets, motors, oil engines, &c., lying at Minchinhampton, Leighterton, and Rendcombe (Glos.) and Hereford. For particulars see our advertisement pages to-day.

Vickers Norwegian Company. — An announcement published in a Norwegian newspaper intimates that the name of Westinghouse Norsk Elektriak A.S., has been changed to that of Vickers Norsk A.S. of Christiania.

LIGHTING AND POWER NOTES.

Accrington. — New Plant Proposed. — Alderman Higham, chairman of the Electricity Committee, reports that the electrical engineer has been instructed to proceed with a scheme to complete the station, now capable of holding plant to take a constant load of 20,000 h.p. At present the load varies from 5,000 to 6,000 h.p. They were installing further plant to give a load of 8,000 h.p. Unless they secured immediate borrowing powers they would pass through a period of the year very favourable for installing new plant.

Barrow-in-Furness.—Loan Sanctioned.—The Electricity Commissioners have given formal consent to the borrowing of £34,493 in connection with the electricity undertaking.

Water-Power Schemes.—The Town Council is contemplating a scheme for generating electricity by means of water power at the Backbarrow Falls of the River Leven. The scheme is estimated to cost £80,000, though there is a larger scheme for the whole of Furness, Cartmel, and South Cumberland, estimated to cost £500,000. Further details of the waterfall scheme are to be obtained and considered by the Council before being put before the Commissioners.

Belfast.—Breakdown.—On December 6th a stoppage at the electricity works put a large amount of factory machinery out of action, while the whole of the tramway services were held up.

Bolton.—Year's Working.—The accounts of the electricity department for the year ended March 31st last, show a total revenue of £200,569, compared with £138,672 in 1918-19. Working expenses amounted to £140,248, against £91,623, leaving a gross profit of £60,321 (£47,049). The payment of capital charges reduced this to a debtor balance of £2,671, which, however, was more than covered by the surplus of £4,432 brought forward from the last period. The number of units sold rose from 23,715,040 to 24,944,906, and the price obtained per unit from 1·06d. to 1·26d.

Bourne End.—Provisional Order.—The Bourne End and District Electricity Corporation, Ltd., is applying to the Electricity Commissioners for a provisional order to supply electricity to the parishes of Woodburn, Little Marlow, and Hedsor, &c.

Buckingham.—Proposed Municipal Undertaking.—The Town Council has instructed the Lighting Committee to consider the question of establishing a municipal electricity undertaking.

Canada.—Toronto Purchase.—An agreement has been reached between the interests represented by Sir William Mackenzie, the City of Toronto, and the Ontario Hydro-Electric Commission, by which the City of Toronto and the Hydro-Electric Commission acquire the Electrical Development Co., which operates the transmission service between Toronto and Niagara Falls, the Toronto Electric Light Co., which competes with the civic electric plant, and the Metropolitan, Scarborough, and Port Credit Radial Railway, which terminates in Toronto. The total price for the Metropolitan Radial Railway, the Electrical Development Co., and the Toronto Electric Light Co. is $32,734,000 (£8,183,500). The city contributes to the purchase $7,811,000 (£1,953,000), for which it acquires the Toronto Electric Light Co. and the Radial Railways centring in the city. The balance of the amount is assumed by the Hydro-Electric Commission, with the approval of the Ontario Government.—*The Times.*

Cannock.—Bulk Supply.—It was reported at a meeting of the Urban District Council that a draft agreement had been approved with the Wolverhampton Corporation for the supply of electricity in bulk to the Cannock area. A site for a transformer station is to be obtained on the Cannock side of the area.

Ceylon.—Hydro-electric Development.—It is reported that the Government of Ceylon is about to take up vigorously the matter of hydro-electric development in the island. Conversion from steam to electrical operation is contemplated on the railways, and an early beginning is to be made on part of the system, and also with several of the local industries. Ceylon has ample sources of hydro-electric power and a good command of labour, and should soon become a highly-developed industrial centre.—*Indian Engineering.*

Cheriton.—Street Lighting.—The Urban District Council has accepted the offer of the Folkestone Electricity Supply Co., Ltd., to convert 27 gas lamps to electricity.

Crieff.—Water Power.—The Town Council is applying to the Electricity Commissioners for a Special Order to authorise the generation and distribution of electricity locally. The scheme is to harness the water power of Loch Turret. Mr. J. E. MacEwan, A.M.Inst.C.E., is consulting engineer.

Continental.—France.—Paris shopkeepers and hotel proprietors are much perturbed by an application made by the electricity companies of Paris to the Prefect of Police to permit them to reduce the power supplied to commercial establishments between two and five o'clock in the afternoon. The companies admit that they are not short of fuel, but point out that the condition of their plant, which badly needs renewing, makes it impossible for them to supply the necessary power when both the factories and shops are drawing heavily upon it.—*Reuter's Trade Service* (Paris).

Denmark.—The Danish Ministry for Public Works has appointed a committee to investigate the question of the possibility of utilising water powers for hydro-electric works other than those already in use or in progress.

Sweden.—A new electric power company is being formed at Stockholm for the purpose of utilising the power of certain West Norrland waterfalls. The minimum share capital of the company has been fixed at 230,000 kr. Among the founders of the new concern are Messrs. Curt Hirstroem, Tor Ludwigs and Victor Aangman.—*Reuter's Trade Service* (Stockholm)

Norway.—A committee has been appointed by the Norwegian Government to consider the possibility of transmitting electrical power from Norway to Denmark. It is reported that a similar committee has been appointed by the Danish Government, and that the two committees will discuss the question, first separately, and afterwards jointly, if there appears to be any possibility of realising the scheme. Two alternative lines of transmission are mentioned, namely, *via* Goteborg across the Cattegat to Fredrikshavn, and from the South of Norway to Hirtahals.—*Financial Times.*

Switzerland.—At the meetings in June of the Swiss Elektrotechnische Verein and the Verband Schweitzer Elektricitätswerke, agreement was come to for the standardisation of supply voltages. Two series of pressures had been previously proposed:—(1) a.c. at 115, 220, or 350 volts, and d.c. at 110, 220, 440 volts; (2) a.c. at 145, 250, 440 volts, and d.c. at 125, 250, and 500 volts. By a small majority, the first system was declared preferable, and was finally unanimously adopted by the two societies. These voltages are, therefore, declared normal, and firms are asked to conform thereto for new, as well as old, undertakings. These figures stand for the voltages at the terminals of the consumer's apparatus, under a normal load. New rules will shortly be issued for transmission line pressures.

Water power is scarce in Switzerland, says *The Times*, owing to the fact that there has been no rain for many weeks and that the mountain lakes are frozen; Berne municipal authorities announce that electricity may not be used for heating purposes from 6 a.m. to 10 p.m.

Italy.—The Department of Overseas Trade states that the Commercial Counsellor to His Majesty's Embassy in Rome has forwarded to the Department of Overseas Trade the following particulars of the great reservoir and hydro-electric power works which are at present under construction near Palermo, Sicily, by an Italian firm. The particulars are taken from the *Giornale di Sicilia*, which states that the main reservoir, which will be situated at Piana dei Greci, 17 km. from Palermo, will be rendered possible by the construction of a dam 34 m. high, built dry (150,000 cb. m. of masonry), and 400 m. long. This will entail the submersion of over 3,000,000 sq. m. of arable land, which is situated at an altitude of 612 m. above the sea level. The "utilisable capacity" of the reservoir will be 15,000,000 cb. m. The water of the basin will be taken by means of a canal of an approximate length of 13 km., of which 6 km. is tunnelled through the mountain, and aqueducts, which lead into a reservoir cut into the rock, having a capacity of 50,000 cb. m., at a height of 370 m. above sea level. The water will then flow into a tunnel, roughly 1 km. in length, at a slope of 2 per 1,000, and thence be conducted into a pipeway to a level of 406 m. It will thus fall 474 m., and will be used for actuating three groups of turbines, each developing 3,500 kw. Two km. of discharge canal will then take the water to the River Oreto. The works were initiated in June, 1919, and it is hoped to finish them in April, 1921. It is anticipated that the completed work will cost 40,000,000 lire. An overhead line 4 km. in length will carry energy at 10,000 volts from the central station to the outskirts of Palermo, and thence underground to distributing centres. A second cable will supply the industrial quarter of the city at 2,000 volts.

Following upon a disagreement on a question of wages between the Rome Municipal Electric Services Authorities and the electricians, the latter proclaimed a strike, to take effect as from November 30th. The Municipal Authorities have taken steps to assure

reduced lighting arrangements and restricted tramway services by drawing upon the resources of the Rome Gas Co., which serves most of the houses and public buildings.

A later message states that the strike is at an end. The questions at issue are to be decided by arbitration, which will be conducted by the Minister of Labour, Signor Labriota. The men will not receive wages for the days during which they were on strike.—*Reuter's Trade Service* (Rome).

TURKEY.—EXTENSION OF CONCESSION.—The Société Ottomane d'Electricité, which has recently arranged with the Turkish Government for the prolongation of its concession for a further 33 years—that is, until the end of 1953—is arranging for a large extension of its generating plant. At the present time two new boilers and a 10,000-KW. steam turbine and generator are being installed, and it is expected that the latter will result in a considerable economy in coal consumption.

Doncaster.—ELECTRICITY *v.* GAS.—The Watch Committee has been considering alternative electricity and gas schemes for improved street lighting, but has decided not to take any further action in the matter at present.

Faversham.—LOAN.—The Town Council has applied for a loan of £17,000 for electricity purposes.

Glasgow.—BREAKDOWN.—A breakdown of one of the new 15,000-KW. turbo-alternators at the Dalmarnock power station has caused much interruption of the electricity supply. Another new alternator is being connected up.

Grays.—ELECTRICITY IN HOUSES.—The electrical engineer has been instructed to prepare alternative estimates for electric lighting and for electric lighting and cooking in the houses being erected by the Council. A new type of electrical cooker is being experimented with.

Harrogate.—LOAN.—On December 7th an inquiry was made by a Ministry of Transport inspector into the circumstances in which the Corporation desires to borrow £22,000 for electricity works extensions. Mr. G. Wilkinson pointed out that more boiler power was required to meet increased demands for electricity. The Inspector asked questions regarding condensing water, and was informed that a main from the town waterworks ran near the station and could probably supply sufficient water for condensing purposes.

Hereford.—RURAL ELECTRICITY.—During the war the War Office opened a large shell-filling factory at Hereford, and plant was erected for the supply of a large amount of electric power. After the armistice, the factory was closed down, and was about to be dismantled when the Corporation took it over. The city's capacity to supply electric power has thus been largely increased. Many villages and country houses are now lighted electrically, and the number of farmers who employ electricity for power increases every week. It is used for threshing, grinding corn, chaff cutting, and daily work, and its scope seems to be unlimited. The scheme was criticised at the meeting of the City Council on December 8th. In reply, the chairman of the Electricity Committee pointed out that the citizens had the benefit of a modern plant worth £100,000 at no cost to themselves, and that it enabled them to obtain electrical power at a cost of only 60 per cent. over pre-war prices, instead of 100 per cent. He mentioned that they hoped by Easter to be able to supply the northern part of the county, comprising Leominster, Weobley, and Kington.

Heston and Isleworth.—BULK SUPPLY.—The new transformer and switchgear which is being provided to enable the Urban District Council to take a bulk supply of electricity from the Twickenham and Teddington Electric Supply Co., Ltd., has been installed.

Houghton-le-Spring.—ELECTRICITY SCHEME.—The Urban District Council has been recommended by a Sub-Committee to consider the question of lighting the district by electricity.

Iceland.—WATER POWER.—The Government is to lay 31 Bills before the Altinget in February next, one of the most important of which is that relating to the utilization of water power.—*Reuter's Trade Service* (Copenhagen).

Lurgan.—ELECTRICITY SCHEME.—It was reported at an Urban Council meeting that the plans for the new electricity scheme were almost completed.

Maidenhead.—MAXIMUM PRICE ORDER.—The Town Council having applied for an order to increase the charges for electricity, the Ministry of Transport has replied that a maximum of 10d. per unit, instead of 1s., as suggested, should prevent a loss. The Council has decided to press for the 1s. maximum.

Mersey Power Co.—NEW PLANT.—The new additional generating plant of the Mersey Power Co. is nearing completion at Weston Point, near Runcorn, and it is probable that the company will arrange to extend the area of its supply.

Morecambe.—LOAN.—The Town Council has applied for a loan of £3,000 for mains, services, and meters, in connection with the housing scheme.

Nelson.—RESTRICTION OF LIGHTING.—Shopkeepers have been asked to restrict electric lighting up to 5.30 p.m., as the plant is running with from 30 to 35 per cent. overload.

Perth.—NEW PLANT DELAYED.—It is complained that the Corporation's scheme for the development and improvement of the electrical undertaking is being held up. The scheme involves the installation of additional plant at the works, and when the matter came before the Electricity Commissioners for approval, they were not satisfied that the proposed scheme was the only satisfactory method of dealing with the future demands for electricity in the Perth area. They have now informed the Corporation Electricity Committee, that in view of the proposed development of electricity schemes in Perthshire, they desire an interview with the city electrical engineer. The Committee, however, is asking in the first place for the Commissioners' views in writing.

Portrush.—LOAN SANCTIONED.—It was reported at a meeting of the Urban Council, relative to the application for permission to borrow £15,000 for the purpose of the Council's electricity undertaking, that the Electricity Commissioners intimated sanction to the borrowing of £11,985, further consideration to be given to items not covered by this amount.

South Wales.—STRIKE SETTLED.—The recent strike of the 200 stokers employed by the South Wales Power Distribution Co. was provisionally settled by granting the men 3d. an hour extra pending the decision of the J.N.I.C., which is to consider the case to-day (December 17th). The claim made was for 3½d. per hour increase. The strike deprived several collieries in the Pontypool district of power, although sufficient was supplied to keep the pumps and fans working.

St. Annes.—NEW BOILERS PROPOSED.—The electrical engineer has drawn the attention of his Committee to the fact that the maximum demand for electricity considerably exceeds the highest yet recorded, and it will, therefore, be necessary to consider increasing the boiler plant before next winter. The limit of the generating plant is also being reached, but he does not propose taking any steps until the position with regard to national electricity supply is a little clearer.

St. Mellons.—SUPPLY DECLINED.—The Rural District Council has refused to agree to the proposal of the Newport (Mon.) Corporation to extend its electricity supply into the district.

Twickenham.—PRICE INCREASE.—The charges for electricity supplied by the Twickenham and Teddington Electric Supply Co., Ltd., have been revised. The company recently sought power to charge 1s. per unit for lighting, and consumers using slot meters are being asked to pay an extra 3d., making a total of 9d. in the 1s. The unsteadiness of the voltage, combined with the high charges, is driving private consumers to adopt other means of lighting their premises.

Tullamore.—ELECTRICITY SCHEME.—Over 11,220 £1 shares have been applied for in the Tullamore Electric Light and Power Co., out of a total of £25,000. Contracts have been entered into and suitable buildings purchased.

United States.—HYDRO-ELECTRIC SCHEME.—The National Electric Light Association *Bulletin* states that plans to develop hydro-electric energy sufficient to supply light and power demands of 17 cities of the size of Los Angeles have been announced by the Southern California Edison Co. These, according to a statement made by the general manager, contemplate the expenditure of $200,000,000 for the construction of hydro-electric plant on the waters of the Kern and San Joaquin Rivers, Big Creek, Huntington Lake, Shaver Lake and Florence Lake, with an ultimate generating capacity of 750,000 H.P. The programme of the company contemplates the construction of generating plant over a period of 15 years, bringing into service 50,000 H.P. per year. This, according to estimates based on authentic Chamber of Commerce figures, will be necessary to meet the demands for irrigation of agricultural lands and for supplying power to new industries within the territory covered by the Edison service in 10 counties of Southern California and the San Joaquin Valley, which are equal in area to the States of Massachusetts, Connecticut, Vermont, New Hampshire, Rhode Island, New Jersey, and Delaware.

NEW YORK.—The New York Edison Co. is to erect a new power house, to cost $5,500,000, in the Port Morris section of the city.—*Reuter's Trade Service* (New York).

Warrington.—NEW PLANT.—In seconding the acceptance of a tender for two turbo-alternators, each of 6,000 KW. capacity, Sir Robert Peacock explained to the Town Council that it had already sanctioned the purchase of three, but the Ministry of Transport had only authorised two. Delivery would take 16 months, and meanwhile the Council was unable to supply 6,000 KW., for which it had applicants, but was negotiating in respect of 4,000 KW. The Council has given sanction to an application to borrow £20,351 to cover capital expenditure for the next three years, instead of borrowing the money in small amounts.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—LOANS SANCTIONED.—The Corporation has received sanction to borrow the following amounts:—Reconstruction of sections of the tramways, £202,246 for 15 years; new boilers for the electricity works, £42,250 for 15 years.

Brazil.—RIO DE JANEIRO.—Owing to the sudden failure of electricity on Dec. 11th in Rio de Janeiro, the town was plunged into darkness. The tramway traffic was completely paralysed, but police motors and firemen assisted in conveying suburban inhabitants to their homes.—*Morning Post.*

Continental.—Italy.—Various tramway companies, including those in Bologna, Florence, Leghorn, Milan, Palermo, Turin, Verona, and various small Italian towns, are financially embarrassed, owing to the wage demands of their *personnel*, and have formed a combine which proposes to hand over the tramways to the Italian Government or the municipalities. The scheme is being examined by the Minister of Public Works, but the Government is inclined to reject the proposal, not wishing to make a precedent for similar Italian undertakings.—*Economic Review.*

France.—Compulsory good manners should result from by-laws which are proposed by the Seine Departmental Council for all tramway-cars and omnibuses working in the district. The new regulation will compel men always to give up their seats to elderly women or mothers with children.—*Daily Mail.*

Sweden.—It was recently mentioned that the Stockholm Tramway Co. had ordered a total of 50 tramcars from two German firms, the cars being said to weigh from 20 to 25 tons each. It has now been discovered that the bridges in Stockholm are only able to bear weights of up to 12 tons. An inquiry has now been instituted by the managing director of the tramway company for the purpose of ascertaining how to overcome the difficulty and how such an oversight as to the carrying capacity of the bridges could have occurred before placing the orders.

Dublin.—Effect of "Curfew" Order.—The extended "Curfew" regulations in Dublin having curtailed the tramway service for about 2½ hours nightly, the Corporation had decided to dispense with about 60 "spare" men—but, on consideration, and in the hope that the "Curfew" hours might be changed, the provisional notices have been withdrawn for the present. The tramway receipts have suffered badly as a result of the enforced closing down of the service at 9.30 p.m. It is said that the recent increase in the fares has proved ineffective, and that the half-yearly returns, which are due shortly, will compare unfavourably with those of last year.

L. & Y. Railway.—Electrification Deferred.—Replying to the Oldham Corporation as to the suggested electrification of the Manchester to Oldham and Rochdale line, the Lancashire and Yorkshire Railway Co. points out that the present is not the time to embark on the expenditure which such a scheme would entail, but adds that the matter has not been lost sight of.

Liverpool.—High-Speed Track.—The construction of a high-speed track at the side of Prince's Road is estimated to cost £29,795. It is stated that to reconstruct the existing tramways for the same length with paved surfaces would cost £31,556.

At a later meeting of the Tramways, &c., Committee, it was decided to take no further action in connection with the scheme for the present.

London.—Fare Increase.—The revised fares on the London United Tramways system came into force last week, the fares for the longer journeys being those chiefly affected.

Charing Cross Improvements.—At Charing Cross Underground station a new subway, stairways, and booking offices were opened on December 6th.

New stairways lead down from both the East-bound and West-bound platforms to a subway which runs close beneath the District Railway tracks, and the effect is to provide separate entrances and exits for passengers moving between the District platforms and the Tube escalators. By this means congestion will be greatly relieved, if not entirely eliminated. It is reckoned that a daily average of about 130,000 persons use the communications between the District Railway and the Tubes at Charing Cross. To round off the scheme it is intended as soon as possible to construct a footbridge providing a new way out to the Embankment, as well as additional means of crossing from one District platform to the other.—*Daily Telegraph.*

Christmas Arrangements.—At a meeting of the London County Council on December 7th, Mr. W. J. Squires, chairman of the Highways Committee, stated that last year's arrangements with regard to the running of the tramcars on Christmas Day and Boxing Day would be followed. The tramcars would cease to run at four o'clock in the afternoon on Christmas Day, but the services would be maintained throughout Boxing Day.

Special late tramway services would be run on New Year's Eve as usual.—*Daily Telegraph.*

Application for Time Extension.—The London Electric Railway Co. has applied to the Ministry of Transport for an order granting an extension of time for the construction of the authorised railway which will link up Edgware and Hendon with the Golders Green and Charing Cross line.—*The Times.*

Newport (Mon.).—Heavy Deficit.—It is stated that during the first seven or eight months of the present financial year a loss of £10,000 has been incurred in connection with the tramways; £1,000 of this sum represents an actual loss on working, but the renewal of track has necessitated the expenditure of £9,000 out of revenue, owing to the failure of the Corporation to set aside reserves for depreciation and renewals. An application is being made for permission to increase fares by 50 per cent.

Nelson.—Wage Demand.—At a meeting of the Town Council, on December 8th, the chairman of the Electricity and Tramways Committee said the application of the Municipal Tramways Association for advances in wages would involve £1,296 per annum, making a total loss of £2,046. The present tramway track wanted renewing, and would have to be relaid at a cost of about £37,500. For the undertaking to meet its liabilities, 4d. per car-mile would have to be charged.

Stockton-on-Tees.—Proposed Tramway Purchase.—The Town Council, on December 7th, again considered the question of joint tramway control with Middlesbrough and Thornaby. A report bearing on the special case lodged by the three Corporations against certain terms of the tramways arbitration award (withdrawn because Middlesbrough decided not to proceed) was submitted by the Town Clerk. He quoted the decision recently given in the case of the Oldham, Ashton, and Hyde Electric Tramways Co., Ltd., *v.* the Corporations of Ashton-under-Lyne and the Audenshaw and Denton Urban District Councils. Amongst the points stated were three analogous to the points in the special case set down by the Middlesbrough, Stockton, and Thornaby Corporations—viz., (*a*) as to the allowance for engineering; (*b*) as to cost of raising capital; (*c*) as to whether the tramway company was entitled to receive a sum for interest on capital during construction.

U.S.A.—New York.—The cars recently put into service on the New York subways are in many respects similar to those recently delivered to the London Electric Railway, described on another page of this issue. *Indian Engineering* says:—There are fixed seats for 78 passengers and folding seats for 12 more, the latter being used only in the slack hours, as they block some of the doors; at other times they are folded back to free the doors and give standing room. The car is 67 ft. long and 10 ft. wide; it has four doors on each side—two are double and two single ones placed closed together. A separate push-button is provided for opening each door, but there is another single button for closing all doors simultaneously. All buttons are placed on the panel between the two single doors within convenient reach of the gateman, who stands in the middle of the car. Near the doors there are vertical poles and also white enamelled hand grips for enabling standing passengers to support themselves.

TELEGRAPH AND TELEPHONE NOTES.

Brazil.—New Cable.—Santos is, according to *The Times*, being connected with Monte Video by means of a new submarine cable.

Foreign Telegraph Rates.—The rates per word for telegrams to Algeria, Republic of Andorra, Belgium, France, Holland, Tahiti, Belgian Congo, and certain West African French colonies and possessions have been revised.

German Cables.—Dispute Settled.—The differences over the disposition of the German cables were smoothed over at a plenary session of the members of the International Communications Conference sitting at Washington, on December 13th. The negotiations will, therefore, continue, but the basis of the prospective agreement has not yet been disclosed.—*Reuter's Trade Service* (Washington).

Italy.—Automatic Telephones.—The plans have been prepared for the conversion of the telephone network of Rome to the automatic system, with the cables laid underground. For this purpose the city has been divided into seven zones, each to be served with its own exchange. Two of these zones are to be taken in hand at once. The scheme is a part of a general plan to reform the telephone system in all the large towns of the peninsula.

The work has already been begun on the construction of the new urban telephone network in Venice. Some 14,000 metres of cable are to be laid underground, and, in view of the peculiar nature of the soil, topographical conditions, and the narrow and tortuous streets, the work represents an unique task. The cables will be laid in wooden troughs filled with asphalt at a mean depth of 60 cm. The 6,000 pairs of conductors will be carried from the underground cables to the most suitable points of the city by means of 33 rising columns, and branched off by aerial cables in all directions for the service of existing subscribers as of those foreseen from the extension of the network up to the year 1930. It is anticipated that the completion of the installation will take at least 15 months.

Sweden.—New Cables.—According to the *Elektrotechnische Zeitung*, the Swedish telephone administration, in order to meet the growth of telephone traffic, is to install telephone cables between Stockholm and Gothenburg, Stockholm and Malmö, and between Falköping and Jonköping. The Swedish Government has voted the funds for the first part of the installation, Stockholm and Gothenburg, in order that it may be ready for the projected electric railway line. The cable will be erected along the national highway and furnished with additional plant in five intermediate stations. This will consist of the conductors required for the traffic, both from the intermediate stations and from Stockholm to Gothenburg. To increase the clearness of transmission, Pupin coils will be fitted at every 2·67 km. The number of the conductors, which differ on the several sections, has been calculated on the estimated traffic for the year 1931; but on the first installation, the Pupin coils, will correspond to the demand in the year 1926, and the additions to the immediate demand. The contract has been given to the General Electric Co. The line is about 600 km. long.

Switzerland.—Wireless Telephony.—An interesting demonstration of wireless telephony was made between Chelmsford, England, and Geneva on December 12th, before a group of journalists, who are attending the assembly of the League of Nations, at the Halle de la Reformation. At Geneva the messages were intercepted by the aerial at the recently erected Marconi receiving station, and carried over several miles of landline to the Conference Hall of the League. Messages were spoken by several persons, including Mr. A. Graham Bell, who used an ordinary desk telephone at Marconi House, London, which instrument was connected by a post-office line direct to the Marconi wireless transmitting station at Chelmsford; the messages were automatically relayed to Geneva, where ordinary telephone receivers were used to listen to the messages. A "Stentorphone" was also used, which consists of a magnifying trumpet from which sound is projected by means of a pneumatic fan.

Telephone Call Recorder.—It is reported that Mr. A. W. Wood has provisionally patented an apparatus designed to record the number of unanswered telephone calls. The function of the device is to utilise the energy of the ringing bell to register, by means of a moving tape and self-inking pen, each call that is not answered. If the exchange operator knew the Morse code she could register the number of the caller if he received "no reply."

Telephones.—Sale of Lines.—In a written answer to a question in the House of Commons, on whether he was aware that persons possessing telephones were advertising the sale of their lines, the Postmaster-General stated that the benefit of a contract for telephone service could not be assigned to another person without the consent of the Postmaster-General. Should it be discovered that an attempt was being made to transfer an installation to a new subscriber under the guise of a removal, the transaction was at once stopped. The allocation of surrendered lines rested with the Post Office, and not with the ceasing subscriber.

United States.—International Communications Conference.—The delegates to the International Communications Conference have made a technical recommendation for submission to a general conference of all nations to be held later. The recommendations of the Conference advocate the desirability of increased cables between North America and the Orient, and between America and Australia, and of a cable connecting North America and Italy.

It is proposed that the telegraph and wireless conventions formerly governing international communications shall be amalgamated. Another suggestion is that a Universal Electrical Communications Union shall be established, having for its object the international reciprocal exchange of telegraphic and telephonic communication by land-line, cable, wireless, and all other forms of signalling, as well as the extension and improvement of such means of communication. It is further proposed that an Electrical Communications Council shall be established consisting of representatives of Great Britain, France, Italy, Japan and the United States, and four representatives selected by the other Powers sending delegates to the General Communications Conference. Such Council would meet frequently, its chief function being to encourage the improvement of communication facilities. The Conference also recommends the adoption of the wireless protocol provisionally adopted by the Allies during the war.—*Reuter's Trade Service* (Washington).

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—February 24th. Electricity Commissioners. Plant for the Morwell power scheme—25,000-12,500-kw. turbo-alternators, 600-kw. turbo-alternators, condensing plant, circulating pumps, transformers, and switchgear, copper cable, steel transmission towers, &c. (November 26th.)

Queensland.—January 26th, 1921. P.M.G.'s Department. Telephone apparatus and parts. Schedule 509. (December 10th.)

Sydney.—January 31st. Municipal Council. H.T. and L.T. cable (specification No. 628). Electric Lighting Department, Town Hall, Sydney.

Belgium.—Antwerp. January 11th. Installation of electric light in the bonded warehouses at Antwerp. Copy of the specification in French can be seen up to December 24th, at the Department of Overseas Trade (Room 48), after which date it will be available for loan to firms in the provinces.

Blackpool.—December 31st. Borough Council. Electrical wiring and fitting of the houses on two sites in connection with the municipal housing scheme; 164 houses on the Layton Estate, 246 houses on the St. John's Estate. (See this issue.)

India.—Meerut.—January 17th, 1921. Government of United Provinces hydro-electrical installation. Generating station equipment, including workshop equipment, H.T. transmission and distribution (overhead equipment, including poles), sub-station equipment, pumping station equipment and piping, &c. Mr. G. McHoey, sanitary engineer to the Government, United Provinces, Allahabad.—*Reuter's Trade Service* (Bombay)

Leyton.—January 11th, 1921. Urban District Council. Electric wiring of 142 houses on the Barclay estate. (December 10th.)

Liverpool.—December 20th. Board of Guardians. Electrical supplies for three months for the institutions of the Toxteth Park Guardians. Mr. R. Albert James, clerk to the Guardians, 15, High Park Street, Liverpool.

London.—Battersea.—January 5th. Borough Council Electricity Department. Pipework for a 5,000-kw. turbo-alternator. (See this issue.)

New Zealand.—Napier.—January 17th. Borough Council. One 500-kw. electric generating set. Copies of the specifications and blue prints may be seen at the Department of Overseas Trade, 35, Old Queen Street, S.W.

Auckland. February 22nd, 1921. City Council. One 3,000-kw. H.T. turbo-alternator; two 5,000-kw. H.T. turbo-alternators; four 1,500-kw. rotary converters; four 500-kw. rotary converters, switchgear and transformers; four water-tube boilers, conveyor, pumps, pipework, H. and L.T. cables. (See this issue.)

Paisley.—December 27th. Town Council. The electric lighting work in connection with the Whitehaugh housing scheme. Master of Works, 13, Gilmour Street.

Portrush.—January 1st, 1921. Urban District Council Electricity Department. Gas plant, engines and dynamos, booster and balancer, switchboard, accumulators, overhead and underground cables. (See this issue.)

Rhodesia.—Salisbury.—January 13th. Municipal Council. Electric generating plant, switchgear, cable and converters. Specification (£3 3s.) from the Council's Consulting Engineer, Royal Chambers, Johannesburg.

South Africa.—Johannesburg.—January 13th, 1921. Rand Water Board. Supply and erection of steam boiler, superheater, stoker, economisers, &c., steam turbo-driven centrifugal pumps, condenser, &c., for the Swart Kopjes pumping station. Copies of the specifications, &c., and forms of tender can be seen on application to the Machinery Section, Department of Overseas Trade, 35, Old Queen Street, S.W.

CLOSED.

Aldershot.—Urban District Council :—

Burch & Vertue.—E.L. installations at houses, with flexible wire and lampholders, £342.

Bradford.—Electricity Committee :—

40-ton lifting beam.—T. Broadbent & Sons, Ltd.
One 48-in. retaining valve for water circulating system.—J. Blakeborough and Sons, Ltd.
Runway for riddling hoppers to three boilers.—Herbert Morris, Ltd.
Two E.H.T. transformer switchgear cubicles at Midland Mills.—Ferguson, Pailin, Ltd.
E.H.T. switchgear for two feeders (Odsal sub-station).—Ferguson, Pailin, Ltd.
Two cooling towers.—Davenport Engineering Co., Ltd.
Insulating covering for three boilers.—Hornby & Partners, Ltd.
Cast-iron pipes for turbo-generator and test-tank.—Warth, Mackenzie and Co., Ltd.
One year's supply of A.C. meters.—Metropolitan-Vickers Electrical Co., Ltd., and Landis & Gyr, Ltd.

Tramway Committee :—

One white-metal melting furnace (500 lb. capacity).—Minometer Manufacturing Co., Ltd.
One automatic release bolt screwing and nut tapping machine.—Thomas Chatwin, Ltd.

Doncaster.—Electricity Committee :—

750-kw. rotary converter, £6,828.—Met.-Vickers Electrical Co., Ltd.

Dundee.—The electric lighting contracts in connection with 180 houses for the Corporation have been allocated as follows :

Ponsford & MacHardy.—11 blocks, £634; 11 blocks, £675; 12 blocks, £519.
Lowden Bros.—11 blocks, £619.

Glossop.—Town Council :—

E.L. wiring of houses.—J. Swainson & Co. (£16 10s. per house).

London.—St. Marylebone. Electricity Committee. Underground cables :—

Comparative prices of 1,000 yd. of 19 sizes scheduled were obtained.

Johnson & Phillips, Ltd.	£14,674
W. T. Glover & Co., Ltd.	15,669
British Insulated & Helsby Cables, Ltd. (recommended)	**14,366**
Siemens Bros. & Co., Ltd.	14,747
Western Electric Co., Ltd.	14,564
W. T. Henley's Telegraph Works Co., Ltd.	14,688
Union Cable Co., Ltd.	15,273
Pirelli-General Cable Co., Ltd.	Not complete
Callender's Cable and Construction Co., Ltd.	14,861

Two 1,000-K.V.A. Scott-connected transformers :—

Metropolitan-Vickers Electrical Co., Ltd.	£3,434	Oil-cooled.
British Electric Transformer Co., Ltd.	3,287	
Do. Do. (recommended)	3,416	Air-cooled
Ferranti, Ltd.	3,166	Oil-cooled.
Johnson & Phillips, Ltd.	3,166	
Do. Do.	3,367	

One 8-in. and two 31-in. cast-iron valves required to complete one rotary water strainer and circulating water-pipe connections :—

J. Blakeborough & Sons.—£180 each for 31 in., and £13 each for 8 in.—Recommended.

Ten extra cells for the battery at the generating station :—

Tudor Accumulator Co., Ltd.	£210	Slightly smaller.
Do. Do.	232	Do. larger.
Hart Accumulator Co., Ltd.	216	About the same.
Do. Do.	230	Slightly larger.
D.P. Accumulator Co., Ltd.	222	Same capacity.
Premier Accumulator Co., Ltd.	228	
Pritchett & Gold & E.P.S. Co., Ltd. (recommended)	230	

South Crosland.—District Council. Accepted :—

Electrician's work for ten houses.—Mr. Guy V. Laycock.

Sunderland.—Corporation :—

Jos. Thompson & Co.—550 yd. troughing ; 150 jointing collars.

Pirelli-General Cable Works, Ltd., and Enfield Ediswan Cable Works, Ltd. —L.T. cable.

Winchester.—Town Council :—

Coal conveyor for the electricity works.—C. H. Johnson & Sons, Ltd., £909.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, December 17th. At the Institution, Storey's Gate. At 6 p.m. Paper on "Thermodynamic Cycles in relation to the Design and Future Development of Internal-combustion Motors," by Mr. W. J. Walker.

Junior Institution of Engineers.—Friday, December 17th. At the Royal United Services Institution, Whitehall, S.W. At 7.30 p.m. Presidential address, by the Right Hon. Lord Weir of Eastwood, on "Some Reflections on our Industrial Situation."

Edinburgh Electrical Society.—Friday, December 17th. At the Philosophical Institute. At 8 p.m. Electrical Questions and Answers.

Electro-Harmonic Society.—Friday, December 17th. At the Cannon Street Hotel. At 8 p.m. Smoking concert.

Institute of Marine Engineers.—Tuesday, December 21st. At the Institute, Minories, E. At 6.30 p.m. Paper on "Some Notes on the Management of Marine Diesel Engines," by H. McCririck.

Paisley Association of Electrical Engineers.—Wednesday, December 22nd. At the Technical College, George Street. At 7.30 p.m. Paper on "Some Remarks on Industrial Motors." By J. B. Tannahill.

NOTES.

I.E.E. Subscriptions. — To-night the meeting of Corporate Members to confirm the resolution adopting the Council's proposals for the increase of subscriptions will be held, and proxies have again been issued, in view of Mr. Purse's declared intention of opposing the confirmation of the resolution. It is to be hoped, however, that the opposition will not be pushed to extremes, as the overwhelming majority in favour of the proposals at the previous meeting leaves no doubt as to the outcome in this case also. Unfortunately, the meeting falls on a very unsuitable evening, as several other events are fixed for the same date, including the meetings of the Institution of Mechanical Engineers, the Junior Institution of Engineers, the Electro-Harmonic Society, and a dinner of the Batti-Wallahs' Society ; but the proceedings should not last very long unless a poll is demanded, so that the members will probably not be put to inconvenience.

Summer Time.—Sir J. Baird, Under Secretary to the Home Department, in reply to a question in the House of Commons, on December 7th, said it was proposed to introduce the Daylight Saving Bill in the next session of Parliament.

Service Notes.—Commander R. H. C. Hallifax has been appointed to the cruiser *Hawkins*, flagship of the China Station, for wireless telegraphic service on the staff of the Commander-in-Chief. A number of ex-officers of various electric light companies have been posted to the Territorial Reserve of Officers in their former ranks.

Halifax War Memorial.—On December 15th, the Mayor of Halifax (Alderman T. Hey) unveiled a memorial to the employés of the Corporation Electricity and Tramways Departments who fell in the war. The memorial is a very large frame, containing the photographs of the 52 men who lost their lives. The unveiling ceremony took place under the auspices of the Electricity and Tramways Employés' Social Athletic and Benevolent Society, at the Society's club-rooms.

London Electrical Engineers Old Comrades' Association. —It has been decided to affiliate the London Branch R.E. Old Comrades' Association and the Old Comrades' Associations of the 1st and 2nd London Divisional Engineers and the London Electrical Engineers. R.E. Old Comrades should apply to the Secretaries of either of these Associations at 10, Victoria Park Square, E. 2 ; the Duke of York's H.Q., King's Road, Chelsea, or 108, Heathwood Gardens, Charlton, S.E. 7, in case of need.

The New Electricity Supply Bill. — On Tuesday last Mr. Arthur Neal, M.P., Parliamentary Secretary to the Ministry of Transport, explained to a meeting of representatives of the Press the circumstances under which it had been decided to drop the Bill now before Parliament, and to bring in a new Bill early next session. The present Bill comprises practically the same clauses as were jettisoned last year. The Commissioners have advised the Minister that the provision of powers to enable them to issue Electricity Stock up to a limit of 25 millions sterling which was included in last year's Bill, should at least be postponed until the effect of the voluntary formation of Joint Authorities, including their own financing by local and other means, has been given a fair trial. The Government, therefore, has decided to withdraw the contentious parts of the Bill, and to substitute a shorter Bill, which it is hoped will receive general assent, and will contain essential provisions without which the Commissioners cannot complete the work of establishing even voluntarily-formed Joint Authorities.

In last year's Act there were no financial provisions included which would enable a Joint Electricity Authority to raise the necessary capital. The new Bill will confer upon the joint authorities the necessary financial powers, including those borrowing for money, and will enable local authorities and electrical undertakers and others in the electricity district to lend money to the Joint Authority, or to assist financially in other ways, such as by guaranteeing interest on loans. Until these financial clauses are passed into law it is not possible for the Commissioners to make the necessary orders establishing Joint Electricity Authorities. Inasmuch as schemes have already been received from three of the districts out of 13 provisionally determined by the Commissioners, and schemes from all the remaining districts must be lodged with the Commissioners before April 30th next, and all these schemes are being prepared on the assumption that the necessary financial powers will be granted by Parliament, it is apparent that further powers are urgently required.

Provision is also made in the new Bill to enable the Ministry to revise the maximum charges at intervals of three years instead of five, and to make this power apply to all companies, as well as to all local authorities.

Finally, power is taken to enable the owners of large railway and tramway power stations to dispose of surplus power for general use. The text of the Bill is now available.

Appointments Vacant.—Assistant electrical engineer (£600) + war bonus = £1,033 per annum, for the L.C.C. Tramways Department ; shift engineer (£322), for the Borough of Warrington Electricity Department ; switchboard attendant (£90), for the Redditch Urban District Council Electricity Works ; meter assistant for the Motherwell and Wishaw Burgh Electricity Works ; engineer manager (£500), for the Electric Light and Power Co., Belize, British Honduras ; telegraph mechanician (£440), for the Posts and Telegraphs Department, Government of the Gold Coast ; shift engineer for the Kilmarnock Corporation Electricity Supply. See our advertisement pages to-day.

Educational.—Dr. Garrard, of the General Electric Co., Witton, spoke on "Engineering Education" at a meeting of the Association of Teachers in Technical Institutions, South Midland Branch, at Birmingham, on December 11th. He urged the re-establishment of the apprenticeship system in workshops, and said the primary condition for the success of the engineering industry was the existence of a sufficient number of well-trained and contented artisans. He advocated a standard scheme for the engineering industry, and favoured the abolition of premiums, on the ground that advancement should be independent of any pecuniary position, and should depend upon the pupil's own ability.

We have received from the Principal of the Technical College, Loughborough, a nicely-produced calendar for 1921. A sheet is devoted to each month, and on every sheet appears a photograph of examples of work done at the institution, indicating a very wide scope in engineering and other work.

Parliamentary. — The Women and Young Persons (Employment in Lead Processes) Bill was read a third time in the House of Lords on December 6th.

Electro-Harmonic Society.—The programme for to-night's concert includes songs by Messrs. Dan Jones, Charles Tree, T. C. S. Bennett, and W. James, in duets with Joe Pearson. Other items are banjo solos by Mr. J. Bull, and a humorous entertainment by Mr. W. Montague. The chair will be taken by Mr. S. B. Donkin, M.Inst.C.E.

National Tramways Dispute.—The Secretary of the Ministry of Labour announces that a special meeting of the Joint Industrial Council for the Tramways Industry was held on December 15th, to discuss the possibilities of a settlement of the workers' claim for an increase of wages. The employers' side found themselves unable to accept arbitration. The Minister of Labour has, therefore, decided to establish a Court of Inquiry under Part II. of the Industrial Courts Act, 1919.

Drake & Gorham Notes.—As we go to press, we learn that the issue of 7-year notes, mentioned in our last issue, was oversubscribed before going to allotment, most of the amount being subscribed by the company's clientèle. In view of the difficulty of raising capital nowadays, this result is naturally very gratifying to the directors.

The Proposed Severn Barrage. — The third interim report (Tidal Power) of the Water Power Resources Committee was issued on the 13th inst. by the Board of Trade, in which prominence is given to the possibility of utilising the tides in the Severn estuary for power purposes. The report (Cmd. 1,079, price 2d.) states that of the various schemes which have been brought to the committee's notice, by far the greater number show no recognition of the very serious technical difficulties involved in harnessing the tides, and few have been worked out in any detail. The committee has, however, had under consideration two tidal power schemes for the Severn estuary, which, although of a preliminary character, were based on investigation of the actual conditions of the site, and were accompanied by estimates of cost. The evidence received was of such promise as to warrant a careful consideration of the possibility of utilising the tides in the Severn estuary for power purposes. The committee adds, that "as a safeguard against undue optimism, it was thought desirable to carry out an independent preliminary examination of the subject on broad lines. A sub-committee consisting of two of our colleagues, Sir Philip Dawson and Prof. A. H. Gibson, was constituted for this purpose," and approached several leading firms of manufacturers of turbines and electric generators throughout the world with the object of obtaining particulars concerning low-head and variable-head turbines and electric generators suitable for tidal power schemes to enable them to frame an estimate. While the assistance obtained in this manner was considerable, it soon became clear that the whole problem was so novel that manufacturers and designers were not in a position to express final and definite opinions on the various questions which were addressed to them. Under these circumstances estimates prepared by the sub-committee, although based on information supplied by the most authoritative sources, were inevitably tentative in character, and in forming an opinion of the scheme it was necessary to make allowance for a considerable margin of error. The committee feels, therefore, that no useful purpose would be served by endeavouring to give any estimate of the cost of the scheme. While on the information before the committee it is not in a position to recommend the Severn scheme as a practical proposition, it is in unanimous agreement that it certainly cannot be dismissed as impracticable, and that a further and more detailed technical inquiry into the subject of tidal power is amply justified and should be initiated without delay. Preliminary estimates indicate, however, that if the Severn tides were used, energy could be generated and utilised at a favourable rate, and that the power obtainable throughout an industrial day of ten hours would be of the order of 260,000 kw., and the consequent saving of coal would be from 1¼ to 2½ million tons annually. This energy, approximating to 1,000 million Board of Trade units per annum, might be utilised by industrial organisations in the Midlands and South Wales, in railway electrification, and by undertakings established on the banks of the Severn near the site of the power development. The committee recommends that, in order to give effect to its conclusions the Board of Trade, in consultation with the Minister of Transport, should set up a special Technical Commission to investigate the possibility, from a commercial standpoint, of utilising the tides for power purposes, with special reference to the Severn estuary.

Ampere-Hour Meters for Use on Electric Vehicles.— The Electric Vehicle Committee recommends that ampere-hour meters for use on electric vehicles should comply with the following general requirements:—

1. The following capacities in amperes to be recognised as standard: 30, 40, 60, 80, 100.

2. The meter should be capable of withstanding without injury a 400 per cent. overload for one minute (the normal load being the rated capacity of the meter as marked thereon), and should record any current flowing in excess of 5 per cent. of the normal current rating. The passage of an overload current (it being permissible to pass lower overloads for a proportionately longer time than one minute) should not cause oxidation of the mercury wherever such is employed in the meter.

3. The meters for use on road electric vehicles should be provided with a dial not less than 3½ in. in diameter. Meters intended for use on industrial electric trucks and tractors should have dials not less than 2½ in. in diameter. The scale should be marked in divisions representing either 1, 5, or 10 ampere-hours per division. The main divisions of the scale and the figures should be so clearly formed that they can be read without difficulty by a person possessing normal eyesight at a distance of 5 ft. The standard dial ranges should be 100, 150, 200, 300, 400, and 500 ampere-hours.

4. The pointer should rotate clockwise on discharge and counter-clockwise on charge, the pointer standing at zero when the battery is fully charged.

5. The needle should have a pointed end. A resetting arrangement should be provided and so constructed that it cannot be interfered with by an unauthorised person.

6. The meter should read correctly on discharge, but slow on charge, the percentage slowness being adjustable (from inside the case) within the limits of 0 to 30 per cent.

7. The meter should be provided with contacts arranged to close a circuit which will trip an automatic circuit-breaker for the purpose of interrupting the flow of the charging current to the battery when the needle of the meter has returned to zero during the charging operations. The trip coil contacts shall be capable of carrying a current of one ampere.

8. The error of a meter when tested should not exceed 5 per cent at any part of the range from one-tenth of full load up to 200 per cent. in excess of the full-load current. Full load is to be construed as meaning the normal rating of the meter in amperes. The error referred to above shall mean the variation from the true ampere-hours in the case of discharge, and in the case of charge the variation from the figure representing the true ampere-hours less the percentage slowness at which the meter has been set to work on charge. The temperature at which a meter is calibrated shall be that given in the British Standards Specification (No. 37) for electricity meters, *i.e.*, 15 deg. C.

9. The case of the meter and the terminals should be of substantial construction, the former being so made that it will effectively prevent the ingress of dust, water, or moisture. No holes should be left through which moisture or dust could enter. If keyholes be necessary to fulfil the requirements they should be provided with covers.

10. The normal rating of each meter in amperes should be clearly marked upon the meter.

INSTITUTION NOTES.

Diesel Engine Users' Association.—At the November meeting of the Association, Mr. Napier Prentice suggested that it was opportune for again considering the question of fuel-oil supplies, and urged the importance of using, if possible, home-produced creosote as a Diesel-engine fuel in place of fuel oil imported from abroad. Even if it was not possible to obtain a sufficiency of suitable home-produced fuel oil, he thought that users in this country should take some action to endeavour to secure for themselves suitable supplies at a reasonable price by co-operation or by supporting any concern that was based on the principle of co-operation between the users, British tar and oil distillers, and other British interests. The National Fuel Oil Co. was essentially a British concern, whose objects were those which the Association itself approved, but was unable to carry out. In the discussion which followed, several members expressed their surprise that, as it had been considered of national interest to restrict the exportation of coal from the country at the present time, it should not equally have been considered in the national interest to prevent the exportation of creosote oil. The discussion on Mr. A. J. Wilson's paper on "The Recovery of Lubricating Oil," adjourned from the previous meeting, was continued.

King's College Engineering Society.—An interesting afternoon was spent by the Society, on December 8th, when the members visited the works of Messrs. Automatic and Electric Furnaces, Ltd., and witnessed demonstrations of the Wild-Barfield automatic steel-hardening furnaces.

Society of Engineers.—A meeting was held, on December 3rd, to consider, as an extraordinary resolution, the increasing of the subscriptions of all classes of members. The resolution was passed unanimously, and is to be placed before a meeting for confirmation on Monday, December 20th.

Barrow and District Association of Engineers.—At a meeting of the Association, last week, Mr. H. G. Leivesley, A.M.I.E.E., delivered a lecture for apprentices on "Electrical Measurements and Electrical Measuring Instruments," Mr. H. B. Weeks, president of the Association, occupying the chair. Mr. Leivesley dealt with his subject chiefly in relation to the application of electrical measurements to industrial engineering. He defined various electrical units, explained how they were used, and described the various indicating and recording instruments in daily use by electrical engineers. The lecturer provided a large exhibit of instruments, and, with the aid of two assistants, gave a number of interesting demonstrations.

Birmingham and District Electric Club. — At the annual meeting of the Club, on December 11th, Mr. A. C. Wynne was elected president. The vice-presidents are Messrs. H. F. Sheventon and N. Deykin; Mr. J. W. Mayall was elected secretary. The Club membership is 141, a slight increase on last year's figures.

Institution of Civil Engineers.—On December 14th, Sir R. A. Hadfield, Bart., and Mr. Sydney A. Main, B.Sc., presented a paper on "Shock Tests and their Standardisation: Including the Effect of High Velocities on Impact up to 2,870 ft. per second."

Liverpool Engineering Society.—On Wednesday, January 5th, 1921, Mr. W. J. E. Binnie, B.A., &c., will read a paper on "Water-Power Problems." Mr. Binnie is a partner in the firm of Sir Alexander Binnie, Son & Deacon, and has recently been engaged on the investigation of the water-power resources of this country.

Institution of Electrical Engineers (Scottish Centre). — A smoking concert was held in Glasgow, on December 11th, when Mr. J. E. Sayers presided over a large assembly. An interesting and varied programme was provided.

Chelmsford Engineering Society.—On December 9th, Mr. W. G. Smith read a paper on "Ether Waves." The paper briefly outlined the controversy between Newton and Huyghens concerning the nature of light, and how Maxwell was led to the conviction that there should be electro-magnetic waves in the ether. X-rays were described, and their production explained.

Rontgen Society. — The adjourned conjoint meeting of the Society with the Institution of Electrical Engineers and the Electro-Therapeutic Section of the Royal Society of Medicine has been fixed for February 10th, 1921

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Captain W. H. U. Marshall, R.E. (T.), M.I.E.E., M.I.Mech.E., after having been on war service for five years, has reopened his office at 2, King's Terrace, Portsmouth, as consulting electrical and mechanical engineer, and is also undertaking the inspection and testing of electrical and steam plant.

Mr. N. J. Young, general manager of Newport (Mon.) Corporation Tramways, has been appointed an employers' representative on the Welsh National Joint Industrial Council.

Mr. J. E. MacEwen, A.M.I.E.E., has been appointed consulting engineer in connection with the electricity schemes at Crieff and Dunblane.

Mr. A. P. Rutherford, late electrical engineer to the Leith Town Council, has been presented by the employés with a revolving office chair.

Swindon T.C. has decided to increase the salary of the electrical engineer, Mr. F. Newey, from £450 a year to £500 as from October 1st. The recommendation of the Finance and Law Committee was that the increase should be from £450 to £600, by £100 from April 1st and £50 from April 1st next, but an amendment was carried making the increase £50 only from October 1st.

St. Helens T.C. has increased the salary of the electrical engineer from £600 to £800 per year, and that of the tramways manager from £575 to £650.

At the annual meeting of the Lourenço Marques Development Corporation, Ltd., it was stated that Mr. W. M. Mordey, M.I.E.E., was leaving England for Lourenço Marques on December 24th as the special representative of the company in their negotiations with the Lourenço Marques Municipality for an increase in their water rates and tramway fares.

Mr. J. Gray, M.C., M.A., Fellow of King's, and the son of Mr. James Gray, of the Electric Construction Co., Ltd., has been elected to the Balfour studentship for research in biology at Cambridge University. The value of the studentship is £200 a year for three years.

Sir Thos. Williams, general manager of the L. & N.W. Railway, will retire at the end of the year, and will join the board. Mr. A. Watson, general manager of the L. & Y. Railway, has been appointed to succeed Sir Thos. Williams, and will continue as general manager of the L. & Y. Railway.

Mr. C. C. Macrae, the deputy chairman of the L.B. and S.C. Railway Co., has been elected chairman in succession to the late Earl of Bessborough, and Lord Henry Nevill deputy chairman.

Fulham B.C. Electricity and Lighting Committee recommends that as from July 1st, 1920, the remuneration of the borough electrical engineer be adjusted in accordance with the minimum scale of salaries for chief electrical engineers of authorised electricity supply undertakings issued by the A.M.E.E. (Great Britain and Ireland) the increase amounting to £1,373 per annum.

Mr. R. Blackmore, A.M.I.E.E., has been engaged to report on the Birkenhead electricity undertaking.

Mr. R. Hoggard, traffic superintendent of the Wigan Corporation Tramways, has been appointed traffic manager to the City of Lincoln Tramways and Motor 'Bus Department, and takes up his duties at Lincoln in the new year. Before being appointed to Wigan in February last, Mr. Hoggard was for 19 years on the staff of the Sheffield Corporation.

Mr. A. H. Darker, chief engineer and manager of the electrical department of Messrs. J. Stone & Co., Ltd., Deptford, has now returned to London after concluding a business tour round the world, occupying some two years and nine months.

Mr. C. R. Webb, of the Cable & Line Construction Department, Western Electric Co., Ltd., North Woolwich, has accepted the appointment of assistant mains superintendent to Shanghai Municipal Council. As a token of their appreciation and good wishes for his future success, his colleagues have presented him with a travelling clock, silver pencil, and autograph album. Mr. Webb was married on December 1st, and sails for the East on the 18th of this month.

Mr. H. Fraser (Stratford-on-Avon) has resigned his position with the Walsall Hardware Manufacturing Co., Ltd., and has been appointed representative for the Birmingham district of the Electrical Engineering and Equipment Co., Ltd., Bank Buildings, 109/111, New Oxford Street, W.C.1.

Obituary.—Mr. F. Moore.—The death has taken place, at the age of 31 years, of Mr. F. Moore, chief electrician at the Markham Main Colliery, Armthorpe, Doncaster.

Mr. G. L. Black.—The death is reported of Mr. George L. Black, assistant engineer to the Corporation Electricity Department, Glasgow. After acting as district mains superintendent, Mr. Black became mains superintendent, and on the recent transfer of Mr. Lackie to London he was promoted assistant to the present manager.

Dr. Alexander Muirhead.—We greatly regret to record the death of Dr. Alexander Muirhead on Monday last.

Wills.—The late Mr. Charles Hopkinson, consulting engineer, of Manchester, left £50,701.

Dr. Frederick Rutherfoord Harris, of Llangibby Castle, near Newport, Mon., a friend and confidential agent of the late Cecil Rhodes, formerly one of Kimberley's representatives in the Cape Parliament, a director of the Cape Electric Tramways Co., and other companies, who died on September 1st, aged 64, has left property of the gross value of £71,949, the net personalty being £7,056.—*Times.*

NEW COMPANIES REGISTERED.

G. J. Thornton, Alder & Co., Ltd. (171,811).—Private company. Registered December 3rd. Capital, £2,000 in £1 shares. To carry on the business of electrical and general engineers and contractors, manufacturers, agents and dealers in all kinds of electrical, mechanical and general engineering appliances, builders' and decorators' manufacturers, &c. The first directors are: G. W. Alder, 9, Richmond Gardens, Shepherd's Bush, W.12; T. D. Clapham, Suffolk House, Worple Road, Epsom. Qualification, £200. Secretary: G. W. Alder. Registered office: 53, Victoria Street, S.W.1.

Airedale Electrical and Manufacturing Co., Ltd. (171,825).—Private company. Registered December 3rd. Capital, £1,500 in £1 shares. To carry on the business of electricians, electrical, motor, mechanical, telephone, heating, welding and general engineers, founders, manufacturers of electrical apparatus, &c. The permanent directors are: J. E. L. Blythe, Lyttle Dean, Derbyshire Lane, Stretford, Lancs., electrical engineer; R. V. Broberg, Main Street, Crosshills, Yorks., electrical engineer; L. E. Wood, 14, London Road, Grays, Essex, electrical engineer. Registered office: 153, Ryan Street, Bowling, Bradford, Yorks.

Thos. Rigby, Ltd. (171,820).—Private company. Registered December 3rd. Capital, £1,000 in £1 shares. To adopt an agreement with T. Rigby, and to carry on the business of electrical engineers and contractors. The first directors are: T. Rigby, "Lyndene," Thorner, near Leeds; G. Scholefield, 65, Brudenell Grove, Hyde Park, Leeds; Mrs. A. D. Rigby, "Lyndene," Thorner, near Leeds. Registered office: 134a, Woodhouse Lane, Leeds.

Manchester Private Telephone and Electric Lighting Co., Ltd. (171,817).—Private company. Registered December 3rd. Capital, £20,000 in £1 shares. To carry on the business indicated by the title. The subscribers (each with one share) are: W. Hilton, 8, Edenhall Avenue, Levenshulme, cashier; J. Cliffe, 8, Cecil Street, Greenheys, Manchester, accountant. The subscribers are to appoint the first directors. Qualification, 1 share. Secretary: W. Hilton. Registered office: 25, Cooper Street, Manchester.

North-Western Anglo-Swedish Electric Welding Co., Ltd. (171,795).—Private company. Registered December 2nd. Capital, £50,000 in £1 shares. To carry on business as indicated by the title. The subscribers (each with one share) are: W. J. Robson, Merthyr House, James Street, Cardiff, engineer and shipowner; E. H. N. Moxon, 101, Leadenhall Street, E.C.3, shipbroker. C. G. Moreland signs as director and manager. Registered office: 340, Liver Buildings, Liverpool.

Medway's Safety Lift Co., Ltd. (171,903).—Private company. Registered December 8th. Capital, £40,000 in £1 shares. To carry on the business of manufacturers and builders of lifts, elevators, escalators, moving staircases, cranes, hoists, and similar apparatus and accessories, whether electrical, hydraulic, manual or otherwise, to acquire the business carried on by E. M. Medway and A. S. Medway as "Medway's Safety Lift Co." The first directors are: E. M. Medway, 20, Dalrymple Road, Brockley, S.E. (director, Surrey Engineering Co., Ltd., and H. C. Iverson & Co., Ltd.); A. S. Medway, 27, Kilmore Road, Forest Hill, S.E. (director, H. C. Iverson & Co., Ltd.); A. G. Mickleburgh, 26, Shorncliffe Road, Folkestone (joint managing director, Tilling-Stevens Motors, Ltd.); P. H. F. Smith, Westborough, London Road, Maidstone (joint managing director, Tilling-Stevens Motors, Ltd.); B. T. Rumble, 30, Piccadilly, W. (director, Tilling-Stevens Motors, Ltd., and Submersible Motors, Ltd.). Secretary: J. Thomas. Registered office: Victoria Works, St. Peter Street, Maidstone.

London Battery and Cable Co., Ltd. (171,816).—Private company. Registered December 3rd. Capital, £5,000 in £1 shares. To take over the business of electrical and general engineers, makers of accumulators and batteries, telephone, telegraph, and electric wires, cables and appliances and carbon carried on as the "London Battery Co." The subscribers (each with one share) are: E. W. Clarke, Beechcote, Vicarage Lane, East Ham, electrical engineer; J. Noone, 16, Dunkeld Road, Goodmayes, electrical engineer. E. W. Clarke is the first director and secretary. Registered office: Hesketh Road, Forest Gate, E.7.

A. Munday, Ltd. (171,846).—Private company. Registered December 6th. Capital, £5,000 in £1 shares. To carry on the business of electric lighting, heating and gas engineers, dealers in electrical appliances and electrical and gas fittings, &c., and to adopt an agreement with A. I. Munday. The subscribers (each with one share) are: A. I. Munday, Hazeles, Welcomes Road, Kenley, electrical engineer; Mrs. J. E. Munday, Hazeles, Welcomes Road, Kenley. A. I. Munday is permanent governing director. Registered office: 59, Watling Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rushmores (1919), Ltd.—Particulars of £150,000 authorised November 25th, 1920; present issue, £111,000; charged on the company's undertaking and property, present and future, including uncalled capital.

Calcutta Electric Supply Corporation, Ltd.—Particulars of £500,000 debentures authorised July 14th, and covered by trust deed dated November 17th, 1920, whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital. Trustees: Metropolitan Trust Co., Ltd.

General Cable Manufacturing Co., Ltd.—Satisfaction in full on December 3rd, 1920, debenture dated November 6th, 1917, securing £1,500 notified. Also particulars of £6,000 debentures authorised December 3rd, 1920, whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Electric Car and Accessories Co., Ltd.—Debenture dated November 21st, 1920, to secure £500, charged on the company's undertaking and property, including uncalled capital (if any). Holder: F. C. Macaskie, Trinity Street, Leeds.

Pinkney & Forster, Ltd.—Satisfaction in full on June 7th of charge dated March 1st, 1920, securing all moneys due or to become due from the company to bankers.

Chepstow Electric Lighting and Power Co., Ltd.—Particulars of £3,000 debentures authorised October 29th, 1904, of which £2,000 were issued on November 15th, 1920, charged on the company's undertaking and property, present and future, including uncalled capital.

Engineering Equipment Co. (1919), Ltd.—Satisfaction in full on November 30th, 1920, of debentures dated June 3rd, 1919, and March 17th, 1920, securing £25,000.

Watford Electric and Manufacturing Co., Ltd. (formerly Thomas Kesnor & Co., Ltd.).—Satisfaction in full on October 1st, 1918, of mortgage dated December 28th, 1911, securing all moneys due or to become due from the company to bankers. (Notified December 3rd, 1920.)

Cryselco, Ltd.—Satisfaction to the extent of £8,800 (being amount issued) on June 30th, 1920, of debenture stock dated May 20th, 1915, securing £10,000.

Essex Light Railway and Property Co., Ltd.—Memorandum of deposit on December 1st, 1920, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd., charged on 272, Ashburton Road, Canning Town, E.

Electrical Industries, Ltd.—Debenture dated December 1st, 1920, to secure £1,050, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Industrial Debenture Corporation, Ltd., 16, King Street, E.C.2.

Accumulators of Woking, Ltd.—Debenture dated November 30th, 1920, to secure £12,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: London County, Westminster and Parr's Bank, Ltd.

Barsi Light Railway Co., Ltd. (44,589c).—Return dated October 29th, 1920. Capital, £300,000 in £10 shares; 26,000 shares taken up and £260,000 paid. Mortgages and charges, £119,300. Latur Extension debenture, part of £125,000 issued, £5,700 having been redeemed.

Fors Accumulator Foreign Patents, Ltd. (108,151).—Return dated January 11th, 1920 (filed September 8th). Capital, £3,000 in £1 shares (952 preferred and 2,048 ordinary); 584 preference and 2,048 ordinary shares taken up; £132 paid and £2,500 considered as paid. Mortgages and charges, £125.

Electric Supply Corporation, Ltd. (52,036).—Return dated October 28th, 1920. Capital, £250,000 in £5 shares; 42,000 shares taken up and £175,000 paid; £35,000 considered as paid. Mortgages and charges, £154,914.

Wardle Engineering Co., Ltd.—Mortgage dated November 19th, 1920, to secure £4,000 charged on certain land and buildings in Stretford, Lancs. Holders: Mrs. Evelyn Maude and Miss Ellen Mary Wilkinson, Thornfield, Old Trafford, Lancs.

CITY NOTES.

Ferranti, Ltd. The annual meeting was held on December 10th. The chairman, in moving the adoption of the report, said that at the annual meeting last year the directors were unable to submit any accounts, the reason being that there were still many outstanding matters to be settled with the Government on munitions contracts, and also on matters of taxation with regard to munitions levy and excess profits duty. Considerable progress had been made since that time, and now all outstanding matters in respect of munitions contracts had been definitely settled, and the company was just upon the point of making final payment, which would close all accounts between the company and the Government. With regard to taxation, considerable progress had been made. They now submitted the profit and loss accounts for the two years to June 30th, 1919, and June 30th, 1920. The accounts showed that the net profit for the year to June 30th, 1919, after providing for all expenses and charging interest on debenture stock, notes and loans, and making the usual allocation to depreciation reserve and provision for taxation, amounted to £18,251; while the profit for the year to June 30th, 1920, after making similar provision, was £36,622, which was double the profit for the year to June, 1919. The year to June 30th, 1920, was the first full year of the trial of the policy to produce three definite lines of manufactures—namely, meters, power transformers, and measuring instruments. The results on the whole, considering the difficulties which had had to be overcome, might be regarded as satisfactory, and the output, in measure of quantity as well as monetary value, showed a very large increase on the figures of any previous year, excluding, of course, the munitions period. Turning to the position as shown by the balance sheet at June 30th, 1920, the leasehold land and buildings, plant and machinery, were valued by Messrs. G. H. Larmuth and Sons in April, 1919. The figures in the valuation had been adopted as the book value of these assets upon that date, and all capital additions since that time have been added thereto. In consequence of the figures brought out by the valuation, £50,000 had been transferred from the depreciation reserve account to the general reserve account, increasing the latter to £72,000. Schemes of reorganisation of the capital account had been very carefully considered by the board from time to time, and they felt that it was desirable to postpone submitting a definite scheme until general monetary conditions were more favourable for raising additional capital. In consequence of this decision, the directors had decided to recommend that two years' arrears on the preference shares should be paid. With regard to the present year the order book was in a satisfactory condition.

Allgemeine Elektrizitats Gesellschaft. The report of the directors of the A.E.G. of Berlin has been issued in reference to the year ended on June 30th, 1920. It does not give any clear insight as to the actual influx of capital resulting from the various financial operations carried out during the 12 months; no information is given concerning labour conditions, wages, and salaries; the foreign business is only briefly mentioned, and the complicated transaction in the Lausitz glass tube (for bulbs) industry, although of later date than the end of the financial year but of previous date to the circulation of the report, is also ignored.

Dealing with the capital transactions, the report recalls the issue of 4½ per cent. debentures for 100,000,000 marks in November, 1919, and the increase of 100,000,000 marks in the ordinary share capital in May, 1920, of which 42,000,000 marks served for an interchange of shares in the Felten & Guilleaume Co. for 28,000,000 marks. The balance of 58,000,000 marks was issued to the banks, and of this amount the sum of 25,000,000 marks was taken up in the United States as a firm holding under "adequate precautionary measures." It is further mentioned that the emission of 6 per cent. preference shares for 250,000,000 marks as from September, 1920, has been completed.

Coming to consider the course of business during the year, the report states that the orders, of which no figures are given, were abundant, and reached undesirable dimensions during the period when raw materials were scarce. The problems confronting the industry were all the more difficult as the fixing of prices was dependent upon raw materials, exchange, and the labour market. Sales were quantitatively greater than in the preceding year, and the values were very much higher according to the changed conditions of currency. The amalgamation of the glow-lamp factories of the A.E.G., the Auer (German Incandescent Gas Light Co.), and Siemens & Halske in the form of the Osram Co., seemed to have stood the test. During the first half of the year the production of the A.E.G. suffered from strikes, the lack of coal, and the scarcity of electric power, but in the later months a certain regularity and increased disposition to work were manifested. In the apparatus factory manufacturing extensions had to be undertaken as a consequence of the exceptional activity which prevailed, and a brisk turnover also took place in installation materials and meters.

The report proceeds to state that double shifts had to be worked to a large extent in the machine works; sites and buildings of the Oberschonweide Engineering Works were purchased to meet the requirements in the matter of additional room, and a repairing shop was also established at Mulheim, Ruhr. The Oberspree cable factory resumed the working up of copper on a greater scale. In the case of the turbine department, a number of large machines for ships was constructed, especially oil engines; and in the export trade increasing interest was manifested in special types for the delivery or reception of low-pressure steam. The report then mentions that a demand developed in direct trade with Belgium, England, and France for large machine units for industrial power stations, the driving of rolling mills, and the complete electrical equipment of industrial works. After enumerating various orders received in this direction, it is stated that contracts for tramway requirements experienced a considerable decline owing to the unfavourable working of the tramways from a financial point of view, and new lines were practically out of consideration. On the other hand, business in the electric railway department began to develop, particularly in relation to other countries, and a large number of electric locomotives for Sweden had been partly delivered and were partly on order. The department for steam locomotives received orders for new locomotives besides undertaking repairs for the German railways. It is further stated that work on the Berlin high-speed railway—the A.E.G. Schnellbahn—was suspended as a legal dispute had arisen with the City of Berlin.

The report further refers to the portfolio holdings, and states that new shares were acquired in the National Automobile Co., the ordinary shares in the Auguste lignite mine near Bitterfeld were absorbed, and the company also participated in the new issue of share capital by the Deutsche Werft, of Hamburg, which is designed to be the largest shipbuilding yard on the Continent. In the case of the reorganisation of the Zurich Bank for Electrical Undertakings, the report merely mentions that provision had been made in so far as the reconstruction affected the shares held by the A.E.G. The following table shows the financial results in the past two years, together with the corresponding figures for the pre-war year:—

	1913-14 Marks	1918-19 Marks	1919-20 Marks
Share capital	155,000,000	200,000,000	300,000,000
Gross profits	22,640,000	38,306,000	80,295,000
Depreciation	880,000	1,185,000	3,418,000
Net profits	18,160,000	25,990,000	44,675,000
Dividend	15,500,000	20,000,000	28,000,000
,, per cent. ...	10	10	14

The ordinary share capital participating in the distribution for 1919-20 is 200,000,000 marks, although the total amount divided represents only a percentage of that paid on a gold basis for 1913-14. The sum appropriated for bonuses to officials

and workmen, pension funds, and war benevolent funds totals 16,000,000 marks, and compares with 5,500,000 marks in 1918-19, and 2,220,000 marks for bonuses and pension funds in 1913-14. In addition to the ordinary share capital of 300,000,000 marks the loans now reach 202,030,000 marks, as contrasted with 103,530,000 marks a year ago. The ordinary reserve fund remains without change at 74,560,000 marks, and a special reserve fund is shown for 20,000,000 marks.

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.—The accounts for the year ended September 30th, 1920, show that after making provision for doubtful debts and excess profits duty the net profit was £73,299, plus £100,368 brought forward. The dividend on the preference shares paid in January and July required £12,500, and the interim dividend on the ordinary shares paid in July £18,750, leaving a disposable balance of £142,417. The warrants for the half-yearly dividend on the preference shares will be paid on 1st prox. With regard to the ordinary shares, although the accounts show a disposable book balance amply sufficient to pay the usual dividend, the directors feel obliged to defer recommending the payment of a further dividend owing to the present scarcity of cash. This has been brought about by the large cash payments they have been compelled to make to the Government for excess profits duty and income tax, and also by the higher costs of materials and labour which have gone to form the present stocks. The directors hope that it may be possible later to pay a six months' dividend to the ordinary shareholders out of the balance shown at the end of the year. Annual meeting, December 21st.

Tees Power Station Co.—The directors' report for the year ended October 1st states that capital expenditure in respect of the power station amounted at that date to £842,612. During the year 25,200 additional fully-paid ordinary shares were allotted to the Newcastle-upon-Tyne Electric Supply Co., Ltd. The total paid-up capital is now £269,750. The *Financier* states that after considerable delay, owing to the late delivery of material and plant, a section of the power station has been completed, and is about to run on commercial load. It is anticipated that the remainder of the plant will also be brought into operation in January next. The total amount received up to the end of the year from the Newcastle company representing 6 per cent. on the company's paid-up share capital is £15,142, and the directors recommend a dividend of 5½ per cent. on the shares, carrying forward £306.

British Mannesmann Tube Co., Ltd.—The report for the year ended June 30th, 1920, states that the manufacturing profit, including excess profits duty adjustment to June 30th, 1919, and after deducting works charges and depreciation, amounts to £197,064, which, with interest and dividends, royalties and rents £6,627, transfer fees £738, and balance brought forward £72,769, makes £276,188, less administrative expenses (including bank interest) £66,174, leaving £220,013; against this has been charged debenture interest £20,064, income tax (balance), and reserve for corporation tax £37,300, and employés' pension fund £3,033, and there has been transferred to reserve £10,000. A final dividend is proposed of 4 per cent. and a bonus of 1 per cent., making 8 per cent. per annum, plus bonus of 1 per cent., less tax, carrying forward £76,318.

New Issues.—*Barcelona Traction Debenture Issue.*—According to the financial Press, the proportion to be taken up by the underwriters of the recent offer of £1,050,000 8 per cent. secured debentures of the Barcelona Traction, Light & Power Co. amounts to 90 per cent.

English Electric Co., Ltd.—Letters of allotment have been posted in respect of the recent issue of £1,250,000 8 per cent. secured notes. It is understood that the underwriters will be left with about 75 per cent. of the issue.

West African Telegraph Co., Ltd.—The report for 1919 states that revenue amounted to £75,041, ordinary expenses £23,525, cost of maintenance of cables, payments to staff, and other war expenses £37,264, leaving balance, including £90 brought forward, of £14,343. £4,000 has been transferred to reserve, and a dividend at the rate of 4 per cent. has been paid, carrying forward £1,039.

Stock Exchange Notice.—Application has been made to the Committee to allow the undermentioned to be officially quoted:—

Johnson Matthey & Co.—£250,000 8 per cent. seven-year notes.

Coventry Chain Co., Ltd.—Six per cent. per annum on preference shares for six months ended August 31st; on ordinary 7 per cent. per annum, making with interim dividend of 3 per cent., 10 per cent. for the year, and a bonus of 2½ per cent., all less tax.

Anglo-Argentine Tramways Co., Ltd.—The directors have declared arrears of dividend for year to June 30th, 1920, of 5s. 6d. per share, together with six months' dividend to December 31st of 2s. 9d. per share, less tax.

Chile Telephone Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum, free of tax.

Westinghouse Brake & Saxby Signal Co., Ltd.—Interim dividend of 2½ per cent., less tax, on the ordinary shares.

Power Gas Corporation, Ltd.—Profit for the year ended September 30th, 1920, £43,477, plus £10,996 brought forward. £7,000 is placed to reserve. Dividend of 8 per cent., less tax, is recommended. £23,504 is carried forward.

Cape Town Consolidated Tramways & Land Co., Ltd.—According to the *Financial Times*, the accounts for the year 1919 show a loss of £825, which increases the debit balance to be carried forward to £13,422.

Lancashire Dynamo & Motor Co., Ltd.—Interim dividend of 9d. per share, free of tax, on the ordinary shares.

Richardsons, Westgarth & Co., Ltd.—Dividend of 6 per cent., less tax, on preference shares on account of arrears.

Cape Electric Tramways, Ltd.—Dividend of 5 per cent., less tax.

STOCKS AND SHARES.

Tuesday Evening.

The approach of the end of this year is not anticipated with the cheerfulness usually associated with the last days of December. The Stock Exchange is apprehensive of financial trouble developing during the last days of the year, when commitments fall due in various markets, mainly those concerned with commodities and other matters outside the Stock Exchange walls, the settlement of which may engage difficulty and possibly a fresh outburst of liquidation. Of course, the Stock Exchange theory is that plenty of advance trouble-talk frequently means that when the event actually arrives, it is discovered to be less terrible than anticipation painted it, and in this consideration there rests a source of hope that the various settlements which will have to be made in a fortnight's time may be negotiated with greater ease than is expected. The uncertainty, however, lies like one of the current fogs over the markets of the Stock Exchange, and has the effect of reducing business to very meagre proportions.

English Electric Notes were left in the hands of the underwriters to the extent of 75 per cent. It is a sign of the times that this result was received with qualified satisfaction, for some had been talking about the public taking less than a quarter of the total amount offered. The price opened at 4—3 discount, and has kept fairly steady at this level. As the underwriters received 2 per cent. commission, they can get out comparatively cheaply if they choose to do so. Those who undertook to accept the stock firm, and underwrote on this agreement, were paid 2½ per cent. The price of the shares is 15s. 6d. Edisons are 15s., and the first preference have gone back to 20s. Last year, both classes received 10 per cent. dividends. The company's 5 per cent. debenture stock is 2½ lower at 72.

Something of a shock has been caused to the market as a whole by the announcement that the India-Rubber, Gutta-Percha & Telegraph Works' directors feel obliged to defer recommending payment of a further dividend, owing to the present scarcity of cash. The directors say that this position has been brought about by the large cash payments they have been compelled to make to the Government for Excess Profits Duty and Income Tax, and also by the higher costs of raw material and labour which have gone to form present stocks. The accounts show an ample balance for payment of the usual dividend, but owing to the conditions just mentioned, the proprietors will have to go without. It is not as though the India-Rubber Company were one of the mushroom concerns that have sprung up so freely during the war and after-war period. It was established in 1864, and the fact of such a company asking its proprietors to forgo their dividend is sharper criticism to the mind of the business man than columns of clamour in the popular papers.

This announcement from the India-Rubber Company has had the effect of causing heaviness in various other companies of the same class. Callender's weakened to 1½. Siemens are dull at a guinea, and the new shares at 10s., with 12s. paid. Nominal quotations scarcely represent the true state of the market, for in some cases it is exceedingly difficult to get even the lower price of the two quoted. Electric Construction 4 per cent. debenture is 2 lower at 51. Metropolitan-Vickers preference are flat at 33s. 9d., and the ordinary at 16s. 3d. The former changed hands the other day as low as 30s. 7½d.

The same cause is debited as being the reason for the dulness in Eastern Extensions, Globe Telegraph & Trust ordinary and Western shares. The prices have got back to the round £15 again. Evidently the necessity for raising money has caused these shares to be turned out amongst others of the purely investment class that are being realised by those who are obliged to find capital at the present time. They have been held as first-class investments, but the India-Rubber announcement comes as a blow to confidence, and sellers have appeared in the cable market, which, for a long time past, has been about the only firm spot round the House. The flatness is accentuated by rumours, which probably contain a certain amount of truth, as to financial failures in New York and in Paris.

Falls in electricity supply shares have left Charing Cross ordinary 3⅛, Metropolitan ordinary 2⅜, and Westminsters 4⅛. St. James's and Pall Mall are still flat at 6½. County of London preference receded to 8, business being done at 7 15-16. In Westminsters, a transaction is recorded at 4 11-16. Cromptons fell back to 16s. 6d.; General Electrics at 1½ have regained their decline of last week.

Foreigners are heavy with the rest. Anglo-Argentine Tramways 5 per cent. debenture stock is 3½ lower at 53, offering a yield of 9½ per cent. on the money. British Columbia Electric Railway issues are 1 to 3 points down. Brazilian Tractions and Mexico Tramways first mortgage bonds are both easier at 40. Rio Tramways Seconds gave way to 63, and Sao Paulo Consolidated debenture stock to 58½. Nearly all the securities connected with India and the Far East are unfavourably affected by the slump in silver and by the exchange complications caused thereby.

Marconis have lost the benefit which they derived at the beginning of the month from the cheerful statements made by Mr. Godfrey Isaacs upon his return from the United States. The price is 3-16 lower at 2⅜, and Marconi Marines have receded in sympathy to 25s., Canadian Marconis to 7s.

The feature in the Home Railway list is a drop of 2½ in Metropolitan Districts, which has carried down the price to 15½. Underground Income Bonds are 2 lower at 64½, the £10 shares and shilling shares showing losses of 5s. and of 6d. at 2 and 5s. 6d. respectively. Steam stocks have mostly followed the same direction. In the Armament group, Vickers have gone a shade below 20s. Amongst rubber shares, the tendency is again heavy, with the produce at a farthing above 1s. per lb. A critical settlement in the raw produce is in course of negotiation this week; both the Mincing Lane and Stock Exchange rubber markets will breathe a trifle more freely when it is concluded.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price Dec. 14. 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	8	12	6	—	£10 0 0
Charing Cross Ordinary	4	7	3⅜	— ⅛	10 7 4
do. do. do. 4½ Pref.	4½	4½	2⅜	—	8 8 8
Chelsea	3	4	3½	—	6 8 0
City of London	8	10	1½	—	8 17 10
do. do. 6 per cent. Pref.	6	6	17/6	—	6 17 2
County of London	7	8	7½	—	10 13 4
do. do. 6 per cent. Pref.	6	6	8	— ⅛	7 10 0
Kensington Ordinary	6	7	8½	—	9 0 6
London Electric	Nil	2½	½	—	10 0 0
do. do. 6 per cent. Pref.	6	6	2½	—	10 18 2
Metropolitan	5	6	2⅜	— ⅛	11 8 8
do. 4½ per cent. Pref.	4½	4½	2½	—	8 0 0
St. James' and Pall Mall	10	12	6½	—	9 12 0
South London	5	6	2½	—	9 12 0
South Metropolitan Pref.	7	7	16/3	—	8 12 8
Westminster Ordinary	8	10	4½	— ⅛	10 10 6
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	7⅝	—	7 16 10
do. Def.	33/6	1½	16½	—	9 10 6
Chile Telephone	8	6	5½	—	*8 w 1
Cuba Sub. Ord.	7	7	7	—	10 0 0
Eastern Extension	8	10	15	— ⅛	*6 13 4
Eastern Tel. Ord.	8	10	15½	—	*6 11 4
Globe Tel. and T. Ord.	8	10	15	— ¼	*6 13 4
do. do. Pref.	6	6	8½	— ½	7 1 2
Great Northern Tel.	22	22	20½	—	10 14 8
Indo-European	13	10	20	—	8 6 8
Marconi	25	25	2⅜	— 1/16	10 10 6
Oriental Telephone Ord.	10	12	2⅜	—	*4 18 4
United R. Plate Tel.	8	8	6	—	*5 13 4
West India and Panama	1/3	Nil	1/16	—	Nil
Western Telegraph	8	10	15	— ⅛	*6 13 4
Home Rails.					
Central London Ord. Assented	4	4	43½	—	9 4 0
Metropolitan	1	1½	20	—	6 5 0
do. District	Nil	Nil	15½	- 2½	Nil
Underground Electric Ordinary	Nil	Nil	2	— ¼	Nil
do. do. "A"	Nil	Nil	5/-	- 6d.	Nil
do. do. Income	5	4	64½	- 2	—
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	Nil	5½	3	—	9 3 4
do. do. 2nd Pref.	Nil	Nil	3½	—	Nil
do. do. 5 % Deb.	5	5	53	— 3½	9 8 8
Brazil Tractions	Nil	Nil	40	— 1	Nil
British Columbia Elec. Rly. Pfce.	5	5	58	—	8 12 4
do. do. Preferred	2½	5	55½	— 1	*6 6 2
do. do. Deferred	Nil	3	53½	— 2	*6 10 10
do. do. Deb.	4½	4½	66½	—	7 10 5
Mexico Trams 5 per cent. Bonds	Nil	Nil	40	— 2	Nil
do. 6 per cent. Bonds	Nil	Nil	31½	—	Nil
Mexican Light Common	Nil	Nil	16	—	Nil
do. Pref.	Nil	Nil	25¾	- 1	Nil
do. 1st Bonds	Nil	Nil	16½	—	Nil
Manufacturing Companies.					
Babcock & Wilcox	15	15	5⅛	— ⅛	*7 1 2
British Aluminium Ord.	10	10	18/-	—	11 10 2
British Insulated Ord.	12½	15	1⅝	—	9 4 8
Callenders	25	15	1⅝	— ⅛	10 18 2
do. 6½ Pref.	6½	6½	18/9	—	6 18 8
Castner-Kellner	21	17	3	—	5 18 4
Crompton Ord.	10	10	16/6	— 1/-	12 2 6
Edison-Swan	10	10	15/-	—	18 6 8
do. do. 5 per cent. Deb.	5	5	72	— 2½	6 19 0
Electric Construction	10	10	16/6	—	11 8 6
Gen. Elec. Pref.	6½	6½	18/-	—	7 4 5
do. Ord.	10	10	1½	+ 1/16	*8 0 0
Henley	25	15	1⅝	—	9 4 8
do. 4½ Pref.	4½	4½	3½	—	7 4 0
India-Rubber	10	10	1	— 1/16	*8 8 0
Met.-Vickers Pref.	—	8	1½	— ⅛	9 9 4
Siemens Ord.	10	10	1 1/16	— 1/16	*9 8 2
Telegraph Con.	20	20	21	—	*5 14 8

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, December 14th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/16	...
a Ammoniac Sal	per ton	£110	...
a Ammonia, Muriate (large crystal)	,,	£92	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£41	...
a Copper Sulphate	,,	£42	...
a Potash, Chlorate	per lb.	1/-	...
a ,, Perchlorate	,,	1/8	...
a Shellac	per cwt.	£28	£3 dec.
a Sulphate of Magnesia	per ton	£18	...
a Sulphur, Sublimed Flowers	,,	£34	...
a ,, Lump	,,	£30	...
a Soda, Chlorate	per lb.	6d.	...
a ,, Crystals	per ton	£12	...
a Sodium Bichromate, casks	per lb.	...	...
METALS, &c.			
p Babbitt's Metal Ingots	per ton	£95 to £300	...
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1½	...
c ,, Tubes (solid drawn)	,,	1/4 to 1/4½	...
c ,, Wire, basis	,,	1/2½	...
c Copper Tubes (solid drawn)	,,	1/6½	...
c ,, Bars (best selected)	per ton	£139	£3 inc.
c ,, Sheet	,,	£139	£3 inc.
c ,, Rod	,,	£139	£3 inc.
d ,, (Electrolytic) Bars	,,	£91	£2 inc.
d ,, ,, Sheets	,,	£143	...
d ,, ,, Wire Rods	,,	£107	£1 inc.
d ,, ,, H.C. Wire	per lb.	1/1⅜	½d. inc.
f Ebonite Rod	,,	8/6	...
f ,, Sheet	,,	8/-	...
n German Silver Wire	,,	8/-	...
h Gutta-percha, fine	,,	14/- to 16/-	...
h India-rubber, Para fine	,,	1/3	...
i Iron Pig (Cleveland Warrants)	per ton	Nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£54	...
g Lead, English Pig	,,	£35	£3 dec.
g Mercury	per bot.	£14	25/- to 30/- dec.
c Mica (in original cases) small	per lb.	6d. to 4/6	...
e ,, ,, ,, medium	,,	5/- to 10/-	...
e ,, ,, ,, large	,,	12/6 to 25/- & up	...
p Phosphor Bronze, plain castings	,,	1/6 to 1/11	...
p ,, ,, rolled bars and rods	,,	2/5 to 2/8	...
p ,, ,, rolled strip & sheet	,,	2/5 to 2/9	...
d Silicium Bronze Wire	per lb.	1/11	...
r Steel, Magnet, in bars	,,	1/8	...
n Tin, Block (English)	per ton	£213 to £214	£6 to £7 inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/9	...
p White Anti-friction Metals	per ton	£78 to £300	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespears.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
p ———
r W. F. Dennis & Co.

Trade with India.—In the course of an article in the *B.O.T. Journal* dealing with trade between the United Kingdom and India, Mr. T. M. Ainscough, O.B.E., H.M. Senior Trade Commissioner in India and Ceylon, gives a number of useful notes on the present state of affairs. He says that owing to labour dissatisfaction, for which neither employers nor the employed are wholly to blame, the prices of British goods are steadily rising, enabling American, Belgian and even German goods to find an easy market. The longer this continues, the greater will be these inroads in our trade throughout the world and the greater will be the efforts required to dislodge our rivals. India is passing through a very difficult period of financial stringency and trade depression. India emerged from the war in a more prosperous condition than ever, and the increased cost of living was largely offset by the enhanced prices obtained for produce. This boom reached its height in 1919, but the early months of the present year witnessed a decided set-back, and the last few months have been almost entirely dominated by the fluctuations of exchange. Large amounts of Indian capital were forthcoming last year for industrial adventures of all kinds, and the prices of shares rose to absurdly high levels. The inevitable reaction has taken place, and very many operators find that they are financially crippled. Credit is severely restricted, and the banks in India are forced to curtail their advances until there is a freer liquidation of goods. Throughout the whole of the East, from Bombay to Yokohama, there is at present a very serious state of congestion of trade and great financial stringency. In the meantime the greatest care should be exercised by exporters in this country not to add to the present difficulties by shipping goods which they are not sure of disposing of and to modify financial commitments until the position improves. Regarding the financial status of importers, Mr. Ainscough says that India is one of the most dangerous countries in the world to trade with unless a firm has either good agents in the country or maintains its own travelling representatives. Greatest caution in dealing with small Indian companies is urged upon British exporters.

EXTRA-HIGH-TENSION DISTRIBUTION BY UNDERGROUND CABLE.

By REGINALD O. KAPP, B.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

Electricity is to be had at a lower cost at the power house busbars in a super-station than in a smaller power house. On the other hand, the cost of the extra-high-tension distribution system increases steadily as more power is concentrated in a single power house. Therefore, there is a limiting size of power house for any neighbourhood for which the cost per unit to the consumer will be a minimum. It is quite likely that, in many cases, this most economical size will be exceeded by the super-power houses of the future, as other questions, such as a plentiful supply of water for condensing purposes, coaling facilities, &c., are more likely to dictate the size of power house than the question of minimum cost. The result of this is that the capital charges on the E.H.T. distribution system of a super-power scheme will be comparable with the coal bill, and may even exceed it.

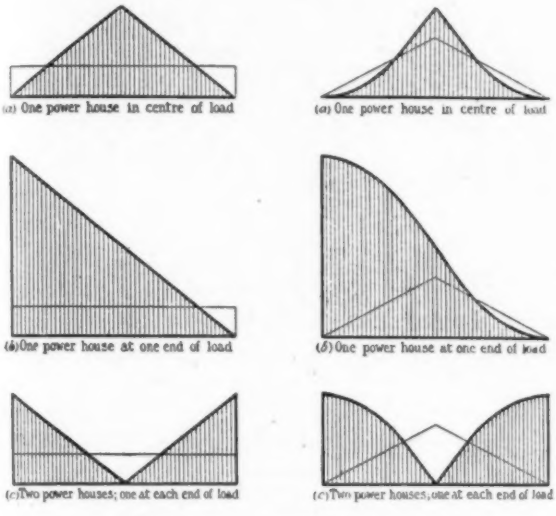

(a) One power house in centre of load
(a) One power house in centre of load
(b) One power house at one end of load
(b) One power house at one end of load
(c) Two power houses; one at each end of load
(c) Two power houses; one at each end of load

Fig. 1.—When Load is Evenly Distributed.

Fig. 2.—When Load Diminishes Evenly from Middle to End of Supply Area.

Cost of E.H.T. Distribution with Different Positions of Power House.

Whereas in the past by far the greatest amount of thought was given to the problem of making the most economical use of coal, we may in the near future expect a greater reduction in the cost of electricity to come from methods for cheapening the distribution system than from increases in generating efficiency.

The object of this paper is to state some of the problems which it appears worth while to discuss in this connection.

The principal point on which E.H.T. distribution differs from low-tension distribution is that, in the former case the limit to the capacity of the cables is almost always set by heating, whereas in the latter case it is more usually set by voltage-drop. Where overhead transmission is used, higher voltages than for cables can be safely adopted, and therefore large quantities of power can often be sent more cheaply in bulk over a long distance. On the other hand, overhead line work is not as cheap as cables when small quantities of power have to be distributed to isolated points of a complicated network. Therefore, the remarks in this paper are only partly applicable to overhead transmission problems.

Choice of Position.—For a given voltage-drop the cheapest cable lay-out occurs when the power house is at the centre of gravity of the load. But the cheapest cable lay-out is not necessarily at the centre of gravity of the load when heating of cables determines their size. There is little or no gain in supplying a town from two power houses.

Figs. 1 to 5 show graphically the relative costs of the distribution system with various positions of the power house for the special case of an area of which the width is small compared with the length. The ordinates of the curves represent the total power flowing across a section of the town, and the total shaded areas represent approximately the total cost of cable. The thin line on each diagram represents the density of demand across a section of the town. If the area in fig. 1 (*a*) is taken as unity, the areas of the remaining figures are as follows:—

Diagram ...	1 (*a*)	1 (*b*)	1 (*c*)	2 (*a*)	2 (*b*)	2 (*c*)
Shaded area	1	2	1	¾	2	¾

The choice of the number and position of power houses will rarely be much affected by considerations of the cost of distribution. The supply of coal and condensing water will generally be the determining factors. But, if the power house is far enough away, it pays to have a transformer house within the boundaries of the town which is supplied at a high voltage, say, 30,000 volts, from which the power for the town is stepped down to, say, 6,600 volts. A question of interest then is to determine the most suitable position for the transformer house. Fig. 3 shows the expenditure on cable theoretically required when the load is evenly distributed over the town.

The limits of the supply area are A and B, and the transformer house is situated at C. The length of the town is l, which is divided in the ratio p/q by the transformer house; a represents the cost per yard of 6,600-volt cable, and b the cost per yard of 30,000-volt cable needed to supply the whole of the town load. The whole of the horizontally and vertically shaded areas between A and B represent the total cost of cable within the limits of the town.

This area is $ap^2/2l+a(l-p)^2/2l+bp$, a/b is the ratio of the cost per yard per kilovolt-ampere of 6,600-volt to 30,000-volt cable. If we make this ratio$=c$ we find that for minimum cost of distribution system $p/l=(c-1)2c$.

Fig. 4 shows a similar diagram for a town in which the density of demand is a maximum at the centre and becomes gradually and evenly reduced to zero at the outskirts. The saving in cost of cable is theoretically a maximum when

$$p/l = \tfrac{1}{2}\sqrt{[(c-1)/a]}$$

The ratio b/a is about 3 if allowance is made for stand-by cable in both cases, and the greater amount of switchgear required on a 6,600-volt network is taken into account. From this it follows that p should theoretically be equal to ½ AB if the load is evenly distributed throughout the town as in fig. 3, and 0.4 AB if the load diminishes evenly from the centre to the fringes of the town as in fig. 4. Various practical factors make these theoretical figures only approximately correct. It would be better to place the transformer houses nearer the fringe of the town than in the positions given by the above theoretical figures.

If the power house itself is on the fringe of the town, and the town is a large one, it may be economical to supply the distant parts at 30,000 volts. The question having been determined, how great an area is to be supplied through the transformer house at the opposite side of the town to the power house, the best position of the transformer house within this area is found by the above formula to be about one-third of the distance across the area. Fig. 5 illustrates the cost of cable for such a scheme.

In this case the voltage at the transformer house must

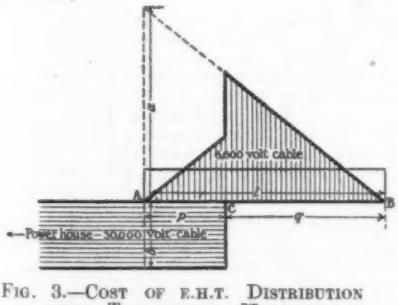


Fig. 3.—Cost of E.H.T. Distribution with Transformer House at Point C and Load Evenly Distributed.

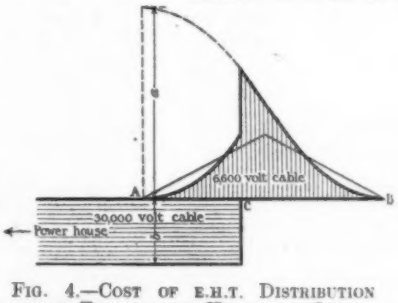


Fig. 4.—Cost of E.H.T. Distribution with Transformer House, and Load Diminishing Evenly from Middle to End of Supply Area.

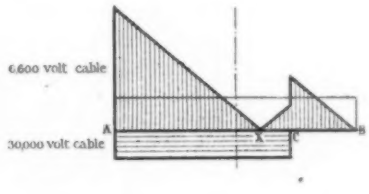


Fig. 5.—Economical Position of Transformer House on a Mixed-voltage System, with Load Evenly Distributed.

be so arranged that the point X in fig. 5 shall be the point of lowest potential on the system. The simplest way of fixing the transformer house voltage and, therefore, the position of the point X, is by means of transformer tappings. The usual transformer tappings of 2½ and 5 per cent. up and down give too coarse a regulation for a mixed voltage system. To get a good range of voltage in small steps with the least possible number of tappings, the author has adopted a scheme with tappings at different points on the step-up and step-down transformers. If, for instance, the step-up transformers have 1½ per cent. tappings up and down, and the step-down transformers 2½ and 5 per cent. up and down, the following percentage voltage variations up and down from the normal are possible:—

0, 1, 1½, 2½, 3½, 4, 5, and 6½ per cent.

That gives us 15 possible ratios.

In the case of E.H.T. cables, heating and not voltage-drop is always the determining factor. For this reason the most economical site for the power house is not at the centre of gravity of the load. This fact is worth emphasising. The most economical site for the power house is roughly such that the sum of the product of each load into its distance shall be a minimum. For the centre of gravity the sum of the product of each load into the *square* of its distance would be a minimum.

The author has not succeeded in finding an analytical method of determining the most economical position of a power house except for the special case of a long, narrow area dealt with already. An ingenious way of solving the problem has, however, been suggested by Mr. C. G. Carrothers. Imagine a map of the supply area to be pasted on a horizontal board and a hole drilled through the board wherever an important load is shown. Bring a string up through each hole and tie all the strings together in a single knot, or fasten them all to one small ring. To the loose end of each string attach a weight proportional to the cost per yard of cable for supplying the load at the point of the map through which its string passes. On the map one will now see a number of strings meeting at one point, their other ends passing through holes to the weights beneath. The potential energy of the system of strings visible on the map is the sum of the product of the tension in each string into the distance between the knot and the hole in the board. The system will automatically adjust itself so that its potential energy becomes a minimum. That is to say, the knot will take up that position on the map which represents the most economical site for the power house.

If the site of the power house is fixed, and the problem is to determine the most economical position of a step-down transformer house, the same method can be used. A hole must be made through the map where the power house is shown, and the weight on the string through this hole must be proportional to the cost per yard of supplying the transformer house from the power house at 30,000 volts. The knot will then take up the most economical position for the transformer house.

Voltage.—The cost of cable per kilovolt-ampere transmitted is less the higher the voltage, and so it would pay in most systems to have the voltage as high as convenient. If increase in the voltage involves the use of transformers, their cost and that of their switchgear must be charged to the E.H.T. distribution, and this makes the cost per kilovolt-ampere greater than that for a lower voltage, unless the transmission distance is great enough to make the saving in cable pay for the cost in transformers and switchgear. Therefore, the highest safe voltage for a given set of conditions is the right one to select, and circumstances may call for the selection of the highest voltage at which (*a*) one can sell power; (*b*) one can generate power; (*c*) one can transmit power. Other voltages cannot be justified.

The author has assumed these to be 6,600, 11,000, and 30,000 volts respectively. Fig. 6 shows the cost of transmission. The actual cost of distribution is higher than that given by the curves.

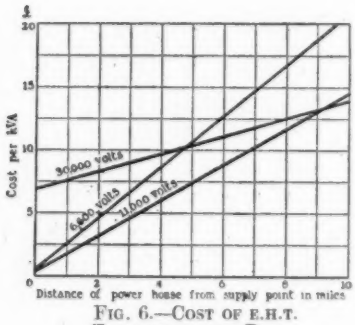


FIG. 6.—COST OF E.H.T. TRANSMISSION IN BULK.

The author would be inclined to adopt a 30,000-volt transmission with a 6,600-volt delivery for distances somewhat less than that given by the point of intersection of the curves shown.

Cable Lay-out.—The problem of designing cable lay-out schemes depends so much on individual cases that generalisations do not apply to it. However, a few guiding principles can be stated.

1. The system should be so arranged that failure of any one feeder does not cause any other feeder to become overloaded.

2. Unless some device such as that suggested in the following section is adopted, link feeders will only carry a small amount of power compared with their load capacity, as the difference in potential between the ends of a link feeder is not great. Therefore, their usefulness as stand-by cables is frequently illusory.

3. Link feeders must not short-circuit any current-limiting reactances that may be installed between busbar sections at the power house.

4. If a consumer is situated between the power house and a sub-station, and is supplied by a cable from the latter, the cost of cable for supplying him is about twice the cost of cable between the sub-station and the consumer, as the power has to make a double journey. Unless the existing cables to the sub-stations are likely to suffice for both loads in future, it may be more economical to lay a new cable from the power house direct to the new consumer, even though that involves a greater immediate outlay.

5. If power is tapped off a feeder, the possible future load that may safely be taken off the end of the cable is reduced by the power tapped off nearer the power house. Unless the cross-section is reduced beyond the tapping point, feeders should only be tapped after the probable future growth of the load has been duly considered.

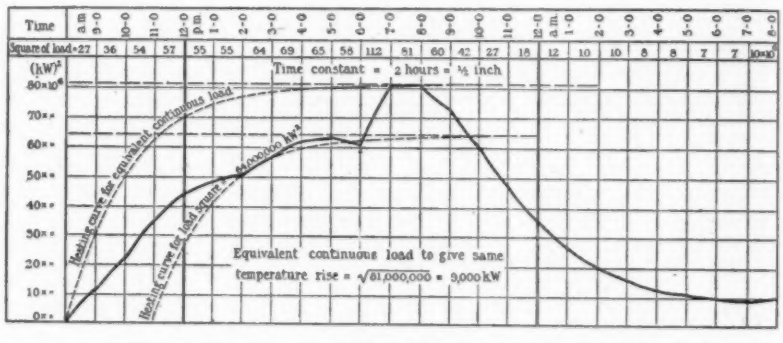

Time
Square of load
Time constant = 2 hours = ½ inch
Heating curve for equivalent continuous load
Heating curve for load square = 81,000,000 kW²
Equivalent continuous load to give same temperature rise = √81,000,000 = 9,000 kW

FIG. 7.—TEMPERATURE CHART OF CABLES ON SEPTEMBER 25TH, 1919.

6. On a ring main the cross-section of copper should be reduced on the feeders furthest from the power house.

7. When the power has parallel paths through feeders of unequal cross-section of copper it will divide so as to give the same current density in each feeder. Advantage cannot, therefore, be taken of the circumstance that the feeder of smaller cross-section may safely be worked at a higher current density than the other.

8. The curves of cost per kilovolt-ampere per mile of 6,600-volt cable show that there is little to be gained by increasing the cross-section above 0.075 sq. in.

Equalising the Load.—Full use can hardly ever be made of all the cables leaving the power house. The total load capacity is limited by the load on that cable which will be most heavily loaded when any of the other cables are out of service.

Link feeders are used to equalise the load between radial feeders as far as possible, but, under purely ohmic conditions of pressure drop on the system, these link feeders do their work very imperfectly.

It appears that boosting transformers or induction regulators on the link feeders would most cheaply and efficiently increase the available network capacity, with a considerable saving in capital cost. For an actual case worked out by the author on an existing undertaking, the load capacity of the distribution system could be increased by an extra cable at a cost of £10.6 per kilovolt-ampere, or by induction regulators at a cost of £4.2 per kilovolt-ampere.

Load Capacity of Cables.—It is not so easy to say when a cable under working conditions is loaded up to the safe limit as might at first sight appear. The mains engineer knows what continuous load his cables can stand. The question that interests him is whether the actual varying load is producing at any time during the day a dangerously high temperature in his cables. The problem may be formulated thus: What is the continuous load equivalent to a given varying load?

One must take account of the progressive heating effect of the varying load during 24 hours or more. Fortunately, this is not such a laborious operation as one might think. Let fig. 7 be a temperature chart of the cable during 24 hours' heating under a varying load. The abscissæ represent time, and the

ordinates temperature. The temperature scale is not actually shown. The smooth logarithmic curve on the same diagram is a heating curve corresponding to that steady load which, if applied long enough, would give the same maximum temperature as the actual varying load. The temperature chart is drawn on the assumption that the load remains constant during the period of one hour. Each part of the temperature chart is, therefore, a small portion of a heating or cooling curve, similar to the smooth logarithmic curve. One such heating curve is continued with dotted lines to show how it forms a portion of such a logarithmic curve. This shows how the cable temperature would have varied with time if the load had been the same throughout the period as it was between 2 p.m. and 3 p.m. It would then have reached a final temperature, given by its asymptote which is the dotted horizontal line.

When the load is such that it would maintain the cable at a constant temperature lower than the temperature of the cable at the time when the load is applied, the cable will cool. The cooling curve is of the same shape as the heating curve, but it approaches the asymptote from above. The horizontal scale depends on a constant which can be defined as the time taken by the cable to reach 63 per cent. of its final temperature, and is called the "time constant." This constant has different values for different cables, and also depends on how the cable is laid.

The method involves little calculation. The whole temperature chart is traced by the manipulation of a piece of tracing paper. The most complicated part is the determination of the average load figures and their squares. The remaining work of tracing the charts for various time-constants could be done by an intelligent switchboard attendant, and each chart would take about 10 minutes. Fig. 7 shows a temperature chart constructed in this way. The greater the time-constant of the cable, the smaller is the equivalent continuous load. The average value of the load for the day in question was 5,830 KW., and the root mean square is 3,090 KW. Hence the load factor was 50 per cent.

In the case of transformers, the final temperature is not proportional to the square of the load. It is proportional to the losses, which are made up of a copper loss that is proportional to the square of the load, and an iron loss that is independent of the load. The equivalent continuous load for transformers is less than that for cables. Therefore, where an E.H.T. feeder and its step-up and step-down transformers are controlled as one unit, their continuous load capacity should not be the same. If the same safety of working is required both for the cables and for the transformers, the former must be rated higher than the latter. The heat capacity of an overhead line is so low that the equivalent continuous load is very near the maximum peak load. Transformers working on overhead transmission might, therefore, safely be rated very much lower than the capacity of the line.

The present state of our knowledge about time-constants is too slight to enable us safely to make full use of the method of determining temperature rise described above. Since, however, a scientific consideration of the actual load conditions may result in a saving of 15 to 25 per cent. of the cost of the distribution system, money spent on research in this connection would be well invested. The capital charges on this saving might represent a charge per unit many times the saving in the cost per unit due to the use of economisers.

Tariffs.—Tariffs designed to obtain the best use from the E.H.T. distribution system will be of greater importance on super-power schemes than they have been in the past. Discriminating tariffs are only justified if they ultimately result in cheapening the cost of energy to the average consumer. If they do not have this effect, a flat rate is preferable.

For a moderately large system a fair average figure for the cost of generators, transformers, and distribution system may be taken to be £15 per kilovolt-ampere of maximum load. At a power factor of 0.8 this becomes £18.75 per kilowatt. An improvement of the power factor from 0.8 to unity would represent a capital saving of £3.75 per kilowatt of maximum demand. The average cost of apparatus or machinery for improving the power factor would come to very much less than this, and so power-factor improvement would very decidedly be an economic proposition on such a system. Load-factor improvement often costs nothing at all. It merely entails a little care in starting up heavy machinery.

If the distribution system is to have the full benefit of power-factor improvement, the apparatus or machinery must be installed on the consumer's premises. The cheapest method is generally that by which phase advancers are installed on each individual large motor. The drawbacks of divided responsibility and difficulty of supervision make it impracticable for the supply authority to install these, so a tariff discriminating enough to make it worth the consumer's while to improve both his load and his power factor best meets the case. In the author's opinion the tariff of a large supply undertaking ought invariably to discriminate between a good and a bad power factor. For small undertakings a discriminating tariff is rarely worth while. Wherever the nature of an industrial load is such that the consumer can improve his load factor, the tariff should also be based on maximum demand, that is, should discriminate between good and bad load factors.

The time has come when electricity supply undertakings should have publicity departments run by a well-paid staff. These departments should supply readable literature and personal help and advice. Among other things, it would be the duty of such a department to advise consumers how to keep down excessive peaks by adjusting the times of working of heavy machinery, and by exercising care in starting it up. It would also advise them on the best methods of improving the power factor in each particular case. It is to the interest of the consumer, the supply undertaking, and the industries of the country generally that electricity should be used to the best advantage, and the supply engineer is the man in the best position to help towards this end. The cost of giving free advice to power consumers and generally keeping them informed of the possibilities of reducing their electricity bills would be a small item in the budget of a large supply undertaking, and would ultimately result, not in a reduced, but an increased revenue.

THE NATIONAL PHYSICAL LABORATORY.

On Wednesday evening, the 8th inst., the optics, thermometry, heat, and radiology divisions of the Physics Department of the National Physical Laboratory at Teddington were, by the kind permission of the director, Sir Joseph Petavel, open for the inspection of a number of interesting exhibits of apparatus. Doubtless the perversity of the weather may be credited with the responsibility for the paucity of the number of visitors. Nevertheless those of Sir Joseph's guests who availed themselves of the opportunity afforded for witnessing the various demonstrations that had been arranged, considered themselves well repaid. Those who have been privileged to take part in the annual visit of inspection to the Laboratory will find these pleasant evening (or in the summer time afternoon) gatherings a welcome means of prolonging the all too brief time that is afforded for the public inspection of the wonderful collection of plant and apparatus that is housed in Bushy House and its surrounding buildings. Moreover, public knowledge of the *raison d'être* and importance of the Laboratory and its fascinating work is none too extensive, and any innovation that is calculated to stimulate interest in its activities should be encouraged.

On the occasion of our visit last week the first department inspected was the Heat Division where visitors were initiated into the method of calibrating an optical pyrometer at the melting points of gold and palladium. The pyrometer is sighted into a black body furnace, consisting of a long refractory tube with a resister winding of platinum foil. This tube is surrounded by a coaxial tube also wound with platinum foil, the whole being fixed in a well lagged case. By raising the outer tube to a temperature of 1,300 deg. C. it is found possible to reach a temperature of 1,550 deg. C. within the inner tube, which is within 200 deg. of the melting point of platinum. In the centre of the inner tube a small plug is fixed, which has the junction of a thermocouple exposed on it, and also a short length of gold or palladium wire. The ends of the latter are connected to a millivoltmeter by two platinum wires. A small E.M.F. is applied and the rupture of the circuit on the melting of the gold or palladium is indicated by a movement of the pointer. A reading of the thermocouple is taken at the melting point, and this enables the furnace to be kept steady while a series of observations is made with the optical pyrometer.

The next piece of apparatus examined was that used for investigating the convection currents in granular materials, and the effect of horizontal baffles thereon. It consists of a vertical surface built up of a number of plates. Each plate contains a flat heating coil, the energy dissipation of which can be measured, and on either side of the hot plate two cold plates are fixed and the interspace packed with granulated cork. Coefficients for the heat transmission are obtained for each element of the surface, and the marked influence of the convection current set up demonstrated. Horizontal baffles of cardboard have the effect of diminishing the values of the coefficient for the bottom portion of the wall, and increasing it for the upper part. Typical curves were exhibited.

With the apparatus used for determining the heat loss by convection from a vertical cylinder of known height, measurements are made of the electrical energy which has to be supplied to maintain the surface temperature of the cylinder at constant value. The temperature is determined by thermocouples, and corrections are made for radiation and for conduction along supports, &c. The combined anemometer and thermometer employed to determine the velocity and temperature distribution of the air stream near a hot vertical plate consists essentially of a fine platinum wire in one arm of a Wheatstone bridge which, with a small current in the bridge, acts as a resistance thermometer; and with a large current as a hot-wire anemometer. In the vertical hot-air channel, for use in calibrating the anemometer, air is drawn by a fan through an electric heater into a wide vertical channel, provided with a honeycomb grid and layers of wire gauze at the entrance, to break up eddies and ensure vertical flow. The anemometer wire is placed in the large channel and the air velocity is deduced from Pitot-tube readings of the swifter flow in a subsequent Venturi neck.

In the potentiometer room was exhibited a duplex reversal key designed for reversing in one movement the battery and

thermoelement connections to a potentiometer. To the bottom of the key four amalgamated copper cups are fixed, and to the ebonite cover four plungers; midway between the cups and plungers is a moving platform carrying four cups with plunger prolongations. Movement of the handle in one direction brings the bottom of the movable cups up against the fixed plungers, whilst the reverse motion causes the plunger prolongations of the movable cups to come into contact with the bottom cups. A spring is so arranged as to keep the surface pressed together in both positions of the contacts.

A simple form of apparatus for determining coefficients of expansion at high temperatures is based on the measurement of the differential expansion of fused silica and the specimens under test, and the expansion is measured by means of a dial indicator commonly used in engineering work. This form of measuring apparatus has an advantage over micrometers which are liable to force out the bottom of the tube if accidentally left screwed down when the temperature is raised. An alternative method of measuring expansion coefficients was also shown in addition to the method of standardising an optical pyrometer by use of a tungsten arc, and various types of apparatus for measuring the humidity of the air in cold stores. Two novel instruments were shown for the latter purpose. The first type is based on the evolution of heat in dry cotton when brought into a moist atmosphere. Two similar coils of nickel wire are wound on a frame, and are both cotton-covered, but one is shellac-varnished to render it impervious to moisture. The coils form two arms of a Wheatstone bridge, which is balanced, and when the frame is brought from a dry to a moist atmosphere heat is evolved in the uncovered cotton, which causes a rise in temperature of the nickel wire, and throws the bridge out of balance. The deflection of the galvanometer gives a measure of the humidity. The second type of instrument is based on the change of the refractive index of a glycerine film according to the amount of moisture absorbed from the air. A cigarette paper dipped in glycerine is placed on the prism of an Abbe refractometer, and when the glycerine has attained equilibrium with the air, the humidity can be deduced from the refractive index. Modified forms of the dew-point, wet- and dry-bulb hygrometers, and an absorption hygrometer were also on view, while in the basement the refrigerating plant and cold storage room were examined, and thermal conductivity tests of good insulators were watched with much interest.

In the Thermometry Division considerable pains were taken to explain to visitors the various methods of testing meteorological types of thermometers as carried out in water comparison baths, and also of clinical and precision thermometers. For comparing the latter type of instruments sent to be tested with the Laboratory standards baths employing water, oil, or fused salts are made use of.

In the Radiology Division an oscillograph used for the examination of the potential wave form of induction coils was shown in operation. Other apparatus exhibited in this section consisted of that used for the determination of the intensity of X-rays; for testing radium by the Rutherford direct and Rutherford and Chadwick balance methods; and for testing the definition of X-ray tubes. An X-ray spectrometer and a display of radiographs were other interesting exhibits, while the screen demonstration of the X-ray examination of materials afforded the ladies amusement by revealing the contents of their hand-bags.

The last department to be visited was the Optics Division; in this building, owing to alterations in progress, the middle floor was not open, but in the sextant room the collimator benches for testing the scale errors of sextants were examined as were also the spectacle-lens testing bench, and the photometer bench for determining the loss of light in optical instruments, &c. A simple arrangement for measuring the reflecting power of polished surfaces was shown, and on the top floor was seen interference apparatus for investigating the defects of optical parts such as prisms, lenses, plane parallel plates, &c.; photographic shutter testing; apparatus used in some of the work in progress on the sensitivity and personal equation error of various types of optical setting; autocollinating apparatus for testing telescope objectives; apparatus for measuring coefficients of linear expansion of optical glass up to about 550 deg. C.; test for defective polishing or silvering in mirrors, and polarisation apparatus for the detection of strain in glass.

NEW ZEALAND: A PROMISING MARKET.

The United Kingdom's share of the import trade of New Zealand has continued to decline since the signature of the armistice. Now that the reorganisation of industries at home has had ample opportunity of completion, the time has come to consider what steps can be taken to effect a recovery. The directions in which such efforts should be made (and indeed are already being made) are dealt with in the recently-issued report by H.M. Trade Commissioner in New Zealand (Mr. R. W. Dalton),* a summary of whose remarks, in so far as they are of interest to the electrical and allied trades, is given below. It is gratifying to find mention of the attention which is being devoted by British electrical engineers to the important enterprises on foot in New Zealand for the generation of electricity from water power.

Machinery and metals are the next most important goods, after textiles, purchased by New Zealand from abroad. Great Britain's share in the metal trade declined between 1918 and 1919 from 76 per cent. to 50 per cent., and in the machinery trade from 59 per cent. to 25 per cent.

An examination of the details of imports under these headings gives a good deal of ground for optimism regarding the possibilities of recovery of British trade. While there are weaknesses evident in certain classes of goods, weaknesses many of which existed before the war, the increase in foreign trade in the main has been spread over most of the import lines, and is a natural increase due to the inability of British manufacturers to supply goods. This being so, it should be possible for British firms to recover ground rapidly once given the opportunity of making satisfactory deliveries. So far as metal manufacturers particularly are concerned, one may look forward to recovery to a position closely approximating that existing before the war. So far as machinery is concerned, the British position in this trade was unsatisfactory before the war, compared with the position in other trades. With the development which has taken place at home since the war, there can be no reason why British firms should not secure even a greater share than they had before the war. It is satisfactory to note that H.M. Trade Commissioner sees indications that ground will be rapidly recovered in this trade once the pressure on firms in the United Kingdom is relieved.

Looking at the position generally, there is cause for a good deal of satisfaction, first, that the position at present is no worse, and next, that the possibilities of recovery are so great. Active endeavours, however, will have to be made to effect that recovery.

The following table shows the total imports of machinery, together with the shares of the countries named:—

Countries of origin.	Competitive. 1918.	Competitive. 1919.	Non-competitive. 1918.	Non-competitive. 1919.	Totals. 1918.	Totals. 1919.
	£	£	£	£	£	£
United Kingdom	222,767	440,476	—	—	222,767	440,476
Australia ...	82,976	85,844	—	—	82,976	85,844
Canada	34,183	39,656	—	—	34,183	39,656
United States ...	463,969	812,972	—	—	463,969	812,972
Japan	39,010	52,653	—	—	39,010	52,653
Other countries.	58,248	94,375	—	—	58,248	94,375
Totals ...	901,153	1,525,976	—	—	901,153	1,525,976

The following table is interesting as showing the proportion of the total imports from each of the above countries in the two years under review:—

Countries of origin.	1918. Per cent.	1919. Per cent.
United Kingdom	24.7	28.9
Australia	9.2	5.6
Canada	3.8	2.6
United States	51.5	53.3
Japan	4.3	3.5
Other Countries	6.5	6.1
	100.0	100.0

The share of the United Kingdom in this important class declined in 1918 to its lowest point since the pre-war year, but a slight increase was experienced in 1919. The share of the United States, which has gradually increased during the past five years, accounted, in 1918 and 1919, for about 50 per cent. of the total trade in this class.

Approximately half of the total imports from the United Kingdom and the United States in 1919 consisted of "electrical machinery" and "agricultural machinery and materials." Under the former heading the share of the United Kingdom increased from £71,116 in 1918 to £175,130 in 1919, while the share of the United States increased from £198,384 in 1918 to £298,577 in 1919. Although, as the above figures show, the bulk of this trade emanated from America in the case of "electrical machinery," it may be mentioned that the large proportion of "insulated cable and wire" imported during 1919 came from the United Kingdom, the value of imports from the United Kingdom being £69,959, and from the United States £8,746. Imports of this nature from Japan, during the same year, amounted to £39,884. Many of the goods which have been introduced since the war have been unsatisfactory, and some of the methods of foreign competitors have been unacceptable. Many of the goods which have been imported from other sources have, however, proved satisfactory, and even in the case of goods which were originally unsatisfactory considerable improvement has been shown: in short, the channel of trade to New Zealand has suffered

* Cmd. 1008. Price 4d.

by diversion in certain respects, with the result that the United Kingdom's position on the market is not as strong as it formerly was. On the other hand, the preference of New Zealand buyers for British goods, if it has changed at all, has strengthened. It will not be sufficient, however, to rely on the strengthening of this preference for British goods to effect an entire recovery of British trade with New Zealand. Prior to the war, for reasons stated, active organisation in this market on the part of British manufacturers was probably not as necessary as it was in the case of foreign firms. The position during the war changed so materially, however, that it is thought a very active organisation will now be necessary if United Kingdom manufacturers are to recover ground which has been lost. There are indications that many manufacturers at home are fully realising this necessity, and it is to be hoped that before very long they will be able to carry their ideas into practice.

Active Organisation Needed.

The greatest need will be found to be a more active personal touch with the market. There may not be any reason why the main channels of trade should be altered, but that manufacturers should be in a position to have first-hand knowledge of conditions, and also to have representing them agents whose prime interest is to sell the goods of particular firms. In some trades buyers will naturally revert to British sources of supply as soon as they find that their demands can be met. In others, it is feared that new sources of supply discovered since the war will retain their hold unless active steps are taken by British manufacturers to reintroduce their goods. There is a third class of goods, that is, goods now manufactured in the United Kingdom on a greater scale, which were practically unknown in New Zealand prior to the war, on behalf of which even greater activities will be required if foreign goods, strongly established there prior to the war, are to be removed from their pre-eminent position. It is Mr. Dalton's belief that the accredited agent of the manufacturer working on commission, provides the best means of introducing goods. In view of the changes which have taken place during the war, he is more than ever convinced that personal representation of manufacturers is necessary.

He sees no reason why the system of having accredited representatives of manufacturers should not be carried on side by side with the system of shipping through London houses. This method of shipping to New Zealand has been a common one for a great many years, and it is a method which has been in the main entirely satisfactory.

Encouragement of Agents.

Agents of British manufacturers, during the last few years, have been working under very great difficulties, and it is questionable whether their difficulties are now any less than they have been. It says a great deal for many of the agents in that country that during the war, and since the war, they have remained loyal, in the main, to their British principals. Opportunities have by no means been wanting by which agents could have taken up goods of foreign manufacture, and could have made very considerable profits, and H.M. Trade Commissioner has been surprised at the number of cases in which agents have refused to take advantage of such opportunities, preferring to wait until their British principals have been in a position to give delivery of goods. Manufacturers are urged to realise the position and, in future, to reciprocate in their treatment of their agents for the loyalty which those agents have shown during a very difficult period.

In cases where agents are personally known to their principals there has been an understanding of the actual position, but in many cases agents are unknown, except by correspondence, to their principals. In those cases there is, in the minds of the manufacturers, a feeling that the agent has only his own purpose to serve in carrying their goods, and they fail to realise that he is the employé of the manufacturer, serving, at the same time, his own ends and those of his principal. There are numbers of cases in which agents have toured the whole of the Dominion soliciting business and have received large orders, of which probably only one-tenth were actually accepted. While it is admitted that this state of affairs must be unavoidable under present conditions, it should be clear in the minds of manufacturers that the agent has been incurring as much expense in time and trouble as would have been necessary in pre-war years in return for a very small percentage of the commission which he would formerly have received. In some cases the agent's journey through New Zealand has been carried out at an actual loss by the agent. At the present time it may not matter much to manufacturers whether they receive large orders from New Zealand or not, but when the time of depression comes it will matter to them very considerably that their agents, during the war period, have maintained an interest in their goods. Complaints there on this subject have been very many, and it has been very difficult to convince agents that the difficulties to be met with at home by manufacturers were so great that in a considerable number of cases no better treatment could have been given.

Want of Propaganda.

Mr. Dalton has found a lack of information in the Dominion regarding home manufacturing developments, and he pleads for a more active dissemination of up-to-date catalogues.

The most serious matter which British trade has to deal with in the New Zealand market is the fear in the minds of importers and agents that they are not being treated fairly by British firms on the question of delivery. A feeling exists that advantage is being taken of New Zealand's patriotism in respect of her purchases, to the detriment of her importers. Some very active propaganda work is necessary in this connection. Although New Zealand may not really believe that British firms are neglecting her market with the idea that the patriotic preference for British goods will always be an assurance for recovery of trade there when the demands of other markets fall, undoubtedly a feeling of irritation and uncertainty exists, which ought to be removed.

Public Works.

In connection with the important electrical schemes, particulars of which have from time to time appeared in these columns, it is interesting to note that although American firms had practically a monopoly of the electrical work of the Dominion during the war and were able to consolidate their position to a very important extent, it seems not at all unlikely that British firms will secure a very large part of the contracts for the big works which are forthcoming. Signs have not been wanting of a very much increased interest in this market on the part of British electrical firms. One firm has already established a New Zealand company, and another firm has recently sent out an important representative to examine conditions on the spot very fully. There is room for a good deal of optimism, therefore, in this branch of the business in which British firms have not previously been as prominent as they might have been. In addition to the electrical works in the North Island, a fairly large scheme is proposed in Southland, further extensions to the Lake Coleridge scheme are mooted, and it is also proposed to electrify the Otira railway tunnel. The carrying out of all these works will necessitate the supply of a good deal of plant, and the conclusion of the schemes will create a large market for small motors and other electric appliances.

The new Public Works Minister has been very actively engaged during the last few months carefully examining the general needs of the country, particularly with regard to roads and railways. He has also stated that the Government will carry out an active policy for meeting, as rapidly as possible, the transport needs of the Dominion, dealing first with those works which are most urgently needed irrespective of other considerations. Side by side with this development there must be a continuous active public works policy. The topography of the country is such that no extensive development can take place without extensive engineering work being involved. This being so, it is highly important that British engineering firms should closely watch the progress of events in this Dominion.

In addition to the works which are in the hands of the Government, proposals are also on foot on the part of the Harbour Boards and the municipal authorities for extensive works of various kinds.

THE BRITISH ELECTRICAL AND ALLIED INDUSTRIES RESEARCH ASSOCIATION.

THE Electrical Research Committee, formed by the Institution of Electrical Engineers and the British Electrical and Allied Manufacturers' Association, which for three years was responsible for the co-operative research instituted by those bodies, has now completed arrangements with the Research Department and with the British Electrical and Allied Manufacturers' Association, and is incorporated as a Research Association under the Department of Scientific and Industrial Research.

The Association has a guaranteed minimum income of £16,000 per annum for five years, of which one half is contributed by the Government, which has undertaken to contribute pound for pound against further subscriptions from manufacturers, up to twice the above figure, which would give an income of £32,000 from these sources alone.

The Association has obtained wide powers to promote research and other scientific work, in universities, laboratories, workshops, and elsewhere, and to obtain the co-operation of persons and bodies interested directly or indirectly. Whilst the work already undertaken has been confined to problems urgently requiring investigation, the Association should be able by its position to render valuable service to the community in the collection and dissemination of technical data, and in other like ways.

The character of the work already undertaken gives some indication of the wide field which may be covered. There are included problems of primary importance to manufacturers, such as a comprehensive investigation into composite and fibrous insulating materials, porcelain, and mica, and inquiries into particular classes of apparatus, such as mining switchgear. The present programme includes also investigations of primary interest to the user, such as research on sludging in insulating oils, the preparation of data for standard specifications for the purchase of these and other insulating materials, and a research on the heating of buried cables, which should furnish data of the first importance to engineers

engaged in electric power distribution. A preliminary report on this last mentioned research is about to be discussed at meetings of the Institution of Electrical Engineers in all parts of the country. Prior to the initiation of the work now under review, there was no provision for undertaking costly researches of primary importance to the user as distinguished from the manufacturer. Work of this character has long been urgently required by power supply engineers, consulting engineers, and large users of electric power.

Close co-operation has been established with the British Engineering Standards Association and the National Physical Laboratory, and about a hundred experts, drawn from the universities, Government departments, manufacturers' organisations, and elsewhere, are assisting through the committees of the Association.

Members are being enrolled as follows:—

Ordinary Members.—Members of manufacturers' associations, joining the Research Association under agreements made with the manufacturers' associations.

Trade Members.—British manufacturers not able to enter as members of manufacturers' associations, joining in their individual capacity on payment of an entrance fee of £50.

Associate Members.—British subjects, representative of capital, management, science, or skilled labour, likely to assist in furthering the objects of the Association.

Honorary Members.—Elected for special reasons.

It is hoped to pool the larger portion of the research work of the Association, but special provision is made for conducting researches for groups of members in cases where a group of members desires to secure the results to itself. In such a case the cost is borne by the group, but the group secures the benefit of the Government contribution. Private researches for individual members may be carried out at their sole cost.

Associate members will pay a small annual subscription, in return for which they will be given certain facilities for obtaining technical data, the loan of recent technical works, co-operation with other workers, and, as the scheme develops, all other facilities obtainable only through a central organisation.

The management is vested in the Council, which is elected in the usual manner, save that powers are given to the Institution of Electrical Engineers to nominate a certain number of members. The present membership is as follows:—

Nominated by the Institution of Electrical Engineers.—Mr. C. H. Wordingham, C.B.E. (chairman), Mr. Ll. B. Atkinson, Dr. C. C. Garrard, Messrs. J. S. Highfield, C. C. Paterson, O.B.E., Roger T. Smith, and C. P. Sparks, C.B.E.

Nominated by the British Electrical and Allied Manufacturers' Association.—Messrs. D. N. Dunlop, A. R. Everest, A. P. M. Fleming, C.B.E., E. S. New, W. O. Smith, E. B. Vignoles, and A. D. Williamson.

Nominated by the Department of Scientific and Industrial Research.—Prof. W. H. Eccles and Sir J. E. Petavel, F.R.S., K.B.E.

Arrangements are in hand for rapidly extending the programme of research and the various other activities of the Association. Communications should be addressed to Mr. E. B. Wedmore, 19, Tothill Street, Westminster, S.W. 1, the Secretary and Director of Research, who will welcome inquiries and suggestions.

THE RAPID SUBMERSIBLE SHIP-CLEANER.

In the early spring of 1914 we mentioned a new apparatus designed to clean ships' hulls, without the necessity for dry docking them, which was introduced from Melbourne, and demonstrated in this country. Later in the same year (May 29th) we published some technical details and illustrations of the device.

Although retaining many features of its original design, the apparatus has been recently developed and improved, as was shown by a preliminary trial of the plant on the hull of the s.s. *Australia*, of the British India Line, at the Millwall Dock last month. By the courtesy of the Rapid Submersible Ship Cleaner Co., Ltd., a large party of naval *attachés*, engineers, and others witnessed a second demonstration of the apparatus which took place on the 7th inst. at the Surrey Commercial Docks of the Port of London.

The complete plant comprises a steel boat, the *Rapid I*, which is divided into three main compartments by bulkheads. The forward compartment is arranged as a cabin for the crew, complete with berths, and all necessities for their comfort. The amidship portion of the vessel is occupied by the winch and controlling gear for operating the submersible electrical scrubbing machine, and the after part of the vessel forms the engine room, where an engine drives an electric generator, and also provides the power for propelling the boat. The whole installation is very compact, and the vessel is equipped with electric light throughout, including clusters for working at night.

The electrical scrubbing apparatus consists of a steel frame to which a 12-B.H.P. submersible electric motor is bolted. This frame also carries the scrubbing brush which is circular in section, and 5 ft. long; it is made of coirfibre and brushes of varying degrees of stiffness can be used according to the condition of the vessel operated on. The brush is revolved by the motor through suitable gearing; the motor also drives a bronze propeller which is situated at the rear of the brush, thus when the complete machine is lowered into the water at the side of a ship and the power switched on, the circular brush revolves and is pressed firmly to the side of the vessel by the thrust of the propeller. The whole machine is then lowered to the required depth and raised, brushing as it descends and rises, a strip 5 ft. wide on the side of the ship. When the brush emerges the boat carrying the cleaning gear is moved 4 ft. and the operation is repeated, until the whole length of the vessel has been scrubbed.

The scrubbing machine is raised and lowered by a specially designed electrically-driven winch with barrels for the steel suspension wires and electric cable. The whole is simply controlled by one operator stationed near the boat's side. The scrubber is capable, it is claimed, of removing any description of marine growth from the immersed part of a vessel, and will do so without removing or injuring the paint on the vessel. If necessary, of course, a special scrubber can be used, and the whole of the vessel can be scaled of marine growths, paint, rust, &c., and left perfectly smooth and clean ready for repainting; thus the lengthy and costly operation of hand scaling is obviated.

The plant is capable, it is said, of cleaning a steamer of from seven to eight thousand tons deadweight in about eight hours. The cleaning operation can be done whilst the vessel is taking or discharging cargo, waiting at the buoys, o rat any other time, without in any way inconveniencing the usual working of the ship. The boats carrying the cleaning gear are self-propelled and able to be quickly transferred from place to place.

The power plant comprises one four-cylinder paraffin engine developing 45 B.H.P. at about 1,000 R.P.M. The engine is fitted with forced lubrication to all bearings and the ignition is by high-tension magneto. A centrifugal governor prevents the speed varying more than 3 to 4 per cent. from full to no load. The engine is direct coupled to a weatherproof electric generator of the revolving-field, D.C. exciter armature pattern, developing an output of 22 K.V.A. at 100 volts, 50 periods, 3-phase, when running at 1,000 R.P.M. The machine supplies the current for the submersible brush motor and the electric winch. The brushing gear consists of one of the Submersible Motor Co.'s 12-B.H.P. motors running at 1,420 R.P.M. The motor shaft at the fore end is connected to a mild steel worm driving a phosphor-bronze worm wheel, which in turn drives the brush through steel sprocket wheels and rollet chains. The current is conducted through a C.T.S. three-core submersible cable, and an oil immersed auto transformer starter is provided.

The winch for raising and lowering the brushing gear is driven by a slip-ring, 760 R.P.M., totally-enclosed motor of 4½ B.H.P. continuous rating, and capable of delivering 6 B.H.P. for short periods, driving the winch barrels through a totally-enclosed worm gear.

An indicator dial is fitted to the winch which indicates the depth of the brush below the surface of the water.

The switchgear for the motors is of the three-pole ironclad, watertight type, fitted within easy reach of the operator. The switchboard is mounted on an iron frame, efficiently earthed, and fitted in the engine room of the vessel. The cables are three-core, lead-covered between the switchboard and alternator, and all wiring in exposed positions is well protected.

The boat was built by Messrs. Tom Taylor & Sons; the oil engine is of the well-known Aster marine type. The alternator and the submersible and winch motors were manufactured and erected by Messrs. Submersible Motors, Ltd., and the winch and its fittings by Messrs. Hammond & Champness; the switchboard, wiring, and electric lighting installation were carried out by Mr. F. H. Wheeler.

The German Lamp Industry.—As the danger has arisen that glass works in the district of Lausitz may pass into foreign ownership, and thus threaten the interests of the makers of glow lamps, the Berlin A.E.G. and the Siemens and Halske Co. have decided to make an offer for the absorption of the glass undertakings of the United Lausitz Glass Works Co., of Berlin and Weisswasser, D.L., which turn out important intermediate products for the manufacture of glow lamps. It is proposed to connect the latter's departments with the Osram Co. in so far as they are of importance for the construction of glow lamps, whilst the remainder of the property will be jointly taken over by the A.E.G. and Siemens and Halske Co.

New Ore Conversion Process.—A Norweigan firm A/S Norsk Staal (Elektrisk-Gas-Reduktion), says the *Journal* of the Royal Society of Arts, established during the war, a general process for reducing tungsten acid into tungsten powder and molybdenum sulphide into metallic molybdenum. It claims, according to *Commerce Reports*, that the final products, which are in the form of small tablets, are of the most superior quality, being completely free from sulphur, carbon, or oxygen. It also says that the price for converting the ores into metal is lower than by any other method known by it. It is at present projecting a plant for the reduction of tungstic acid in Norway. The firm is located at Dronningensgt. 22, Christiania, Norway.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Domestic Electrical Appliances.

We recently paid a visit to the showrooms of the Western Electric Co., Ltd., at 60-62, Finsbury Pavement, E.C. 2, where a number of domestic electrical appliances manufactured by the firm were shown us and demonstrated. The washing machine, which is made at the firm's Hawthorn factory, Canada, possesses a number of features leading to ease and safety of operation. This washer has a light but substantial body of copper or galvanised iron with a dull grey finish. The cylinder in which

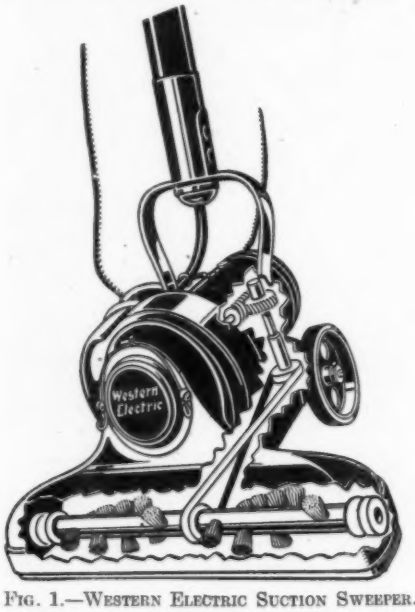


Fig. 1.—Western Electric Suction Sweeper.

the articles to be washed are placed, is of smooth-grained wood. This cylinder is reversed at each 6¼ revolutions by an ingenious bar and pin device to ensure thorough cleansing. The motor is of about ⅛ h.p., and a slipping clutch is provided on a shaft working at right angles to the motor shaft to act in case of overloading or obstruction. All moving parts are entirely enclosed, preventing danger to the operator or to children, and the motor is rendered immune from trouble due to the entry of water by the provision of a splash-proof cover. The wringer is fitted with a neutral and two-direction control, and can be swivelled through an angle of 90 deg. away from the washer. A pulley is provided on the motor shaft in order that the motor may provide a belt drive to any other apparatus when the washing machine is not in use.

The Western Electric vacuum sweeper is provided with a shaft on which brushes are fitted in various positions. The motor is fixed horizontally so that it is possible to use both ends of the armature shaft. On one end the suction fan is fitted and upon the other is a worm reducing gear, which drives the brush shaft (fig. 1). This enables the brushes to be driven at a moderate speed, although the fan is revolving very quickly to give a high vacuum. A small mechanical switch is fitted which enables the brushes to be switched on or off at will. The auxiliary suction tube is fitted in a very simple manner, merely involving the removal of a plate which is kept in position over the suction orifice by a small spring-wire clip, and slipping in the tube connection and replacing the clip. The working of the sweeper is practically noiseless, the motor being efficiently lubricated and the pinion driving the brushes being of rawhide. A vacuum of over 12 in. can be obtained with the fan running at 9,000 r.p.m., while the brush gear is driven at 1,600 r.p.m. The Western Electric sewing machine was also seen. A positive drive is imparted to the wheel of the machine by a small motor through a rubber cone. The motor is controlled by a pedal switch.

A Pulpit Lighting Fitting.

The usual methods adopted for the lighting of pulpits, &c., result in a constant glare either in the speaker's eyes or in those of his hearers. The "Classic" pulpit, lectern or desk fitting has been designed by the Isis Electrical Co., 57, Albert Road, Aston, Birmingham, to remedy this. As will be seen from the illustration (fig. 2) this is an unobtrusive device which confines the light to a small area by means of a cylindrical reflector. This reflector is about 2 in. in diameter and from 10 to 18 in. long. The shade is adjustable, and it is possible to raise the whole fitting from a height of 1¼ in. to 6¼ in. by means of the screws at the sides. The fitting is strongly made in brass, with jointed feet to suit the slope of any desk.

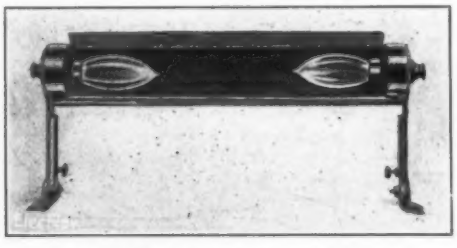
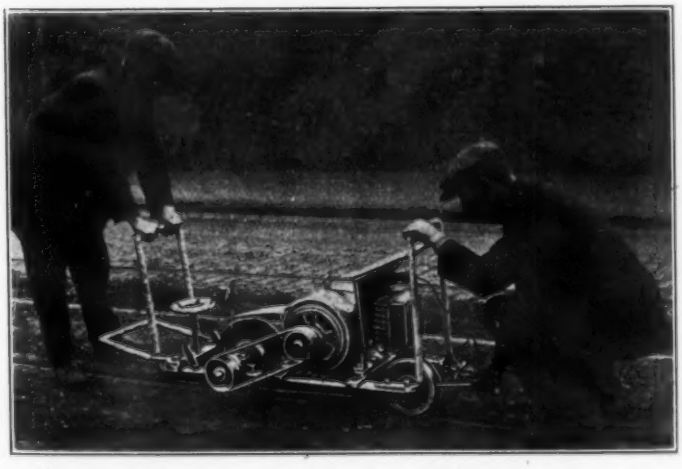


Fig. 2.—The "Classic" Pulpit Fitting.

A Portable Rail Grinder.

Mr. R. Humphries, tramway engineer to the Birmingham and Midland Tramways Joint Committee, has designed and constructed a portable apparatus for grinding the rail head after arc welding dished joints.



Figs. 3 and 4.—A Portable Rail Grinder.

Fig. 3 shows the grinder in operation with a screw adjustment (1) to the grinding wheel. The travel is given (2) by means of a short bar inserted in holes in the periphery of the rear wheel, and as the adjusting screw (1) is round headed and goes into the rail groove a very satisfactory and steady cut can be obtained.

Fig. 4 shows the grinder being run along the rail from joint

to joint. A pole and hook is provided for trolley wire connection, the frame of the machine and rail giving the negative return.

The Bissell Suction Cleaner.

The Bissell electric suction cleaner is not new; it has been working actively for a period of over eight years in the U.S.A., it being a product of the Bissell Motor Co., of Toledo, Ohio, but it is a newcomer to this country, being imported by Messrs. M. K. Cooper & Co., of 15-21, Chapel Walks, South Castle Street, Liverpool. The machine, as will be seen from fig. 5, is larger than, and differs in design from, the familiar type of domestic cleaner. We recently had an opportunity of seeing the machine in operation under ordinary conditions, and the claims made for it appear to be borne out in fact. The machine is supplied complete

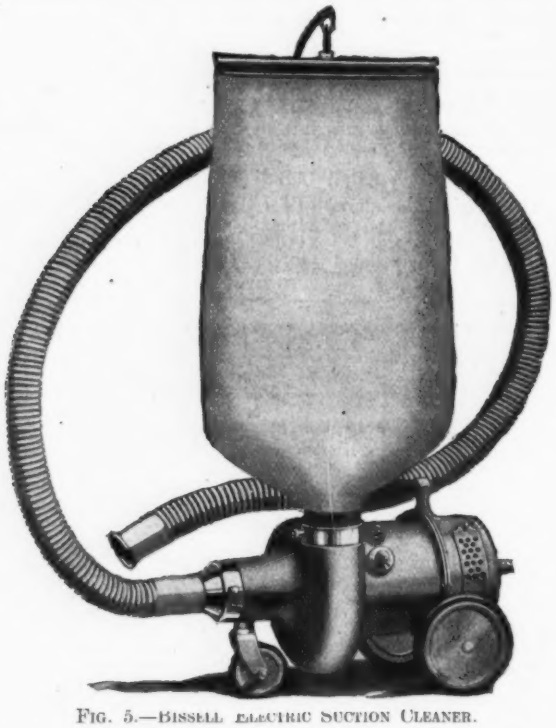


Fig. 5.—Bissell Electric Suction Cleaner.

with various tools and attachments; it is compact, portable, and efficient in operation. Because the operator uses only a light aluminium tool on a fibre tube and a light hose the Bissell cleaner is not only easy to operate, but easy to operate carefully. The ½-H.P. motor, running at 8,000 R.P.M., draws 80 cu. ft. of air through the tool at a velocity of over a mile per minute, thus making it an easy matter to remove even such things as tin tacks and nails from a carpet. As will be seen from the illustration, the cleaner is mounted on three wheels, which are fitted with ball bearings, so that it will run round as the user moves about quite easily. The machine may also be used for power purposes, provision having been made for attaching to the motor shaft such attachments as grinding and polishing wheels, &c.

NEW PATENTS APPLIED FOR, 1920.

NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

33,566. "Emergency brake and switch for motor vehicles." T. A. Carter. November 27th.
33,570. "Electrical communication." D. G. McCaa. November 27th. (U.S., December 4th, 1919.)
33,626. "Electric wiring systems." H. V. Owen, F. G. Quance, and M. J. Railing. November 29th.
33,648. "Electric meters." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. November 29th.
33,649. "Motor control systems." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. November 29th.
33,662. "Spark plugs." Champion Ignition Co. November 29th. (United States, December 26th, 1919.)
33,663. "Spark plugs." Champion Igoition Co. November 29th. (United States, April 10th.)
33,684. "Spring contacts for electric fuse carriers, &c." W. T. Henley's Telegraph Works Co. and W. S. Wakefield. November 29th.
33,687. "Sparking plugs." C. N. Cook (Frieg) and F. Frieg. November 29th.
33,703. "Electro-mechanical utilisation of tides." A. Defour. November 29th.
33,773. "Dynamo-electric machine." W. R. Cooper. November 30th.
33,796. "Systems for controlling electric motors." G. H. Fletcher and Metropolitan-Vickers Electrical Co. November 30th.
33,799. "Electric lamp fittings." A. A. Barron. November 30th.
33,805. "Electric switches." G. Comboni. November 30th.
33,806. "Electric arc welding, &c., and electrodes therefor." C. J. Holslag. November 30th.
33,831. "Motor control." Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). November 30th.
33,832. "Electro-magnetic relays." Cutler-Hammer Manufacturing Co. and Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). November 30th.
33,833. "Motor controllers." Cutler-Hammer Manufacturing Co. and Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). November 30th.
33,839. "Burglar, &c., alarm systems." S. G. Adams. November 30th.
33,846. "Electrically operated door latch control and annunciator device." N. Fienberg and W. L. Wakeham. November 30th.
33,849. "Determining direction of propagation of electro-magnetic waves." J. Erskine-Murray and J. Robinson. November 30th.
33,853. "Wireless electrical signalling." H. S. Mills and H. Wade (Mills). November 30th.
33,874. "Electric resistance welding." R. F. Woodburn. December 1st.
33,878. "Sparking plug." A. Ramsay. December 1st.
33,897. "Electric light fittings." L. Callender and T. L. Callender. December 1st.
33,903. "Fuses for electric circuits." G. Turnock. December 1st.
33,933. "Telephone systems." Automatic Telephone Manufacturing Co. December 1st. (U.S., December 3rd, 1919.)
33,941. "Electric soldering irons." F. Holden. December 1st.
33,942. "Methods of protecting transformers." British Thomson-Houston Co. and H. S. Holbrook. December 1st.
33,951. "Electrically controlled signal operating mechanism for railways, &c." Compagnie Générale Signalisation & McKenzie, Holland, and Westinghouse Power Signal Co. (Compagnie Générale de Signalisation). December 1st.
33,953. "Incandescent gas or electric lamps, &c." E. J. Shaw. December 1st.
33,955. "Employment of retroactively-coupled thermionic tubes, &c." S. Brydon. December 1st.
33,965. "Electrical transformers." Metropolitan-Vickers Electrical Co. (Westinghouse Electric & Manufacturing Co.) and Westinghouse Electric and Manufacturing Co. December 1st.
33,966. "Electro-plating metallic bodies." J. S. Groff. December 1st.
33,994. "Electric switches." C. A. Damey. December 1st.
34,017. "Wireless direction-finding apparatus." R. Widdington. December 1st.
34,019. "Sparking plugs." H. Burton. December 2nd.
34,022. "Electric signal system." H. E. Beswick and T. Gaskell. December 2nd.
34,028. "Electric torch or hand lamp, &c." F. J. Lilliecrap. December 2nd.
34,033. "Electrical ceiling rose and connector box." W. Bull. December 2nd.
34,039. "Sparking plug." P. Marshall and W. A. Stirling. December 2nd.
34,040. "Speed regulation of induction motors." E. Köhn. December 2nd. (Germany, December 20th, 1919.)
34,041. "Electric relays for telephone systems." Automatic Electric Co. and Automatic Telephone Manufacturing Co. (Automatic Electric Co.). December 2nd.
34,042. "Telephone systems." Automatic Telephone Manufacturing Co. and P. N. Roseby. December 2nd.
34,068. "Sparking plugs." J. E. Barrows and W. J. Spicer. December 2nd.
34,092. "Electric lighting systems for motor cycles, &c." C. J. Boswell. December 2nd.
34,105. "Protective apparatus for ring mains or line sections in which direction of electrical energy varies." Siemens-Schuckertwerke. December 2nd. (Germany, December 2nd, 1919.)
34,108. "Incandescent electric bulb lamps." W. B. Ellis. December 2nd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

16,763. "Limit switch mechanism for cranes, lifts, and the like." Ransomes & Rapier and R. S. Lewis. July 4th, 1919. (153,623.)
17,066. "Electric motor control systems." British Thomson-Houston Co. (General Electric Co.). July 8th, 1919. (153,626.)
19,327. "Electric switches." J. B. Tucker and J. H. Tucker & Co. August 6th, 1919. (153,643.)
19,404. "Electric switches." M. Compare. August 6th, 1919. (153,651.)
19,636. "Electric heating units." British Thomson-Houston Co. (General Electric Co.). August 9th, 1919. (153,661.)
19,799. "Electric signalling systems specially applicable to multiple carrier current systems." Western Electric Co. (Western Electric Co.). August 12th, 1919. (153,672.)
20,052. "Wireless receiving systems." J. Scott-Taggart. August 14th, 1919. (153,681.)
20,197. "Electrical batteries." W. T. Coulson and Optalyte, Ltd. August 16th, 1919.(153,687.)
20,284. "Controlling apparatus for electrically operated hoisting mechanism and the like." British Thomson-Houston Co. and R. D. Given. August 18th, 1919. (153,689.)
20,288. "Wireless reception apparatus." J. Robinson, A. K. Macrorie, G. P. Grenfell, and H. Morris-Airey. August 18th, 1919. (153,690.)
20,380. "Machine for popping corn by electric heat." G. Tattersall. August 19th, 1519. (153,693.)
20,662. "Electric hoisting or winding apparatus." British Thomson-Houston Co. (Compagnie Francaise Thomson-Houston). August 22nd, 1919. (153,700.)
20,688. "Heating elements for electric furnaces." E. L. Smalley. August 22nd, 1919. (153,701.)
22,091. "Control devices for electrically-driven lifts, cranes, winches, and like apparatus for dealing with variable loads." A. West & Co and V. Breeze. September 8th, 1919. (153,723.)
26,859. "Electrical contact makers for magnetos." F. McLoughlin. November 1st, 1919. (153,765.)
27,871. "Carriers for electric storage batteries." J. C. Blake and W. McNaught. November 11th, 1919. (153,775.)
29,984. "Electric switches." I. Calvete. December 1st, 1919. (153,787.)

1920.

1,468. "Sparking plugs and methods of making the same." British Thomson-Houston Co. (General Electric Co.). January 16th, 1920. (153,808.)
1,529. "Electric distributing switches." L. E. Hodges. January 17th, 1920. (153,809.)
1,982. "Spark plugs for internal combustion motors." J. O. Brock. March 9th, 1916. (138,108.)
4,260. "Electric switches." J. M. Vavre. March 20th, 1919. (140,379.)
6,090. "Rotary electric hand drills." Siemens-Schuckertwerke. June 26th, 1914. (139,521.)
6,106. "Printing telegraph systems." Western Electric Co. (Western Electric Co.). February 28th, 1920. (153,825.)
13,089. "Telephone systems." Western Electric Co. June 5th, 1919. (144,264.)
14,592. "Variable electric condensers." A. W. Isenthal. October 28th, 1919. (Divided application on 8,628, 1917.) (153,858.)
22,237. "Electrical discharge gap apparatus." Metropolitan-Vickers Electrical Co. August 15th, 1919. (Addition to 123,064.) (149,618.)
22,238. "Electrical discharge gap apparatus." Metropolitan-Vickers Electrical Co. August 15th, 1919. (149,619.)